THE

VETERINARY JOURNAL

SEPTEMBER, 1909.

Editorials.

EPIZOOTIC ABORTION.

THE Departmental Committee appointed in 1905 by the Board of Agriculture and Fisheries to investigate epizootic abortion has at last published a report of its work and findings up to the present date. We may at once say that we consider it one of the most important pieces of work which has ever been undertaken on behalf of the agricultural community. When one considers the difficulties of research work and the length of time necessary before any reasonable results can be obtained or expected in connection with a disease having the special peculiarities of contagious abortion, we are bound to congratulate the Committee. We trust they will be permitted to continue their good work. There is an enormous lot to do yet, but a really good foundation has been laid, and it is a vital necessity that the work should be pushed to a really satisfactory conclusion. We are led to make these remarks by the wording of some parts of the report, which, after mentioning some highly important matter, such as contagious abortion in other species than cattle, says that a future report MAY, not *will*, be issued on the subject. We hope our fears are groundless, and that the whole subject will be thoroughly investigated before the labours of this Committee are terminated.

Of course, the earlier part of the Committee's work was simplified by the knowledge of Professor Bang's work on this disease in Denmark, and although at times doubts appeared as to the identity of the causal organism in the two countries, the final conclusion is that the bacillus is one and the same, and we hope the

suggested name of "Bang's bacillus of cattle abortion" will be universally adopted.

With regard to the methods of infection, it is stated that infection by the mouth has been too little realized, and that transference by the bull has been much over-estimated. We do not entirely agree with the argument given in the latter case, for we submit that the disease may be introduced into a herd by a farmer allowing his bull to serve a cottager's cow recently bought at an auction, and being a draft from an infected herd. The Committee do not deny that the disease *may* sometimes be spread by coition, but they appear to discount it. We doubt if they are justified in so doing, especially in view of the scanty evidence they appear to possess on that point, and the importance of the issue.

The discovery of "abortin" as a diagnostic agent may prove to be of paramount importance, but, of course, it is yet in the experimental stage. However, we have great hopes for it, and we regard it as one of the triumphs of the enquiry. The other great triumph, as far as diagnosis is concerned, is that of the "Fixation of the complement." We understand that this is an almost infallible method of diagnosis, but it is a very complicated laboratory process, and so, of course, will probably not be largely resorted to except in the case of very valuable animals. Up to the present time we have been unable to tell if an animal was infected with this specific disease until she had aborted or was about to abort. By that time the damage was largely done and the premises infected. It may now be possible to prevent such an unfortunate occurrence.

The work on immunization affords hope that a satisfactory method may be discovered, though one is not over-impressed with the report of the results at present obtained. In this connection it is of interest to note that the United States Department of Agriculture has examined and analysed an asserted preventive and curative material called "Roberts' Anti-abortion serum," and reported that it is not a serum and contains no serum.

We have produced a rather long abstract of this report, which deserves to be read in its entirety. After reading it one feels unsatisfied, to an extent, on account of the interest it arouses and the vast amount of work still remaining to be done, yet at the same time feeling thankful that so much has been done.

THE OUTBREAK OF FOOT-AND-MOUTH DISEASE IN SCOTLAND IN 1908.

THE annual report of the Chief Veterinary Officer to the Board of Agriculture (Mr. S. Stockman) contains a detailed account of the outbreak of foot-and-mouth disease which occurred last year in Edinburgh. It is a matter of so much interest that we reprint it on p. 480. We take this opportunity of congratulating the Board of Agriculture and its officers on the success which followed their prompt action in combating it. It is six years since there was a previous outbreak in the United Kingdom, and fifteen years since foot-and-mouth disease was seen in Scotland. One can readily realize the serious anxiety which was caused to stock-owners and agriculturists, and they, above all, must be very grateful for the energetic campaign but for which so many of them would have been in great danger of complete ruination. No doubt the general dislocation of business, such as the closure of markets and the prohibition of the movement of all stock over a very large area, causes great loss and inconvenience; but that is little compared with the loss that would have occurred if the outbreak had not been dealt with in such a capable manner. We think that much credit is due to the Board for having its machinery in such good working order for dealing so urgently with this disease after an interval of six years, especially when one realizes the alarming rapidity with which foot-and-mouth disease may spread.

Similar congratulations are due to the Bureau of Animal Industry in connection with the recent outbreak of foot-and-mouth disease in the United States. The abstract of Dr. Mohler's report (p. 483) makes very interesting and instructive reading.

General Articles.

SARCOPTIC SCABIES OF BOVINES.

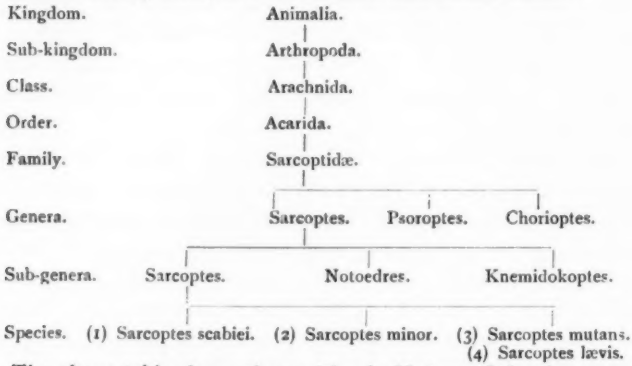
BY A. W. NOEL PILLERS, M.R.C.V.S., SHEFFIELD.

Introduction.—Sarcoptic mange of cattle, or rump mange as it is sometimes called, is almost discredited by Neumann. In the 1905 edition he says that the history of bovine sarcoptic scabies is limited to the possibility of its existence, and he puts very little faith in the various cases recorded.

The cases of Grognier and Fauvet were clearly an infection of cows, with the equine variety of the parasite, *Sarcoptes scabiei equi.* Also Wallraff's cases are regarded as the infection of man, cattle, and horses with the goat sarcopt, *S. scabiei capræ.* Delafond has infected a bull and calf with *S. scabiei canis,* but the condition disappeared spontaneously. Rademacher has recorded a case of a mangy cat infecting a cow, upon whose back it used to rest, and the cow infected human beings. Here, again, bovine sarcoptic scabies is not established, as the parasite of the cat is a different species altogether, viz., *S. minor cati,* which has been found on man. The observations of Thudichum are also not regarded as reliable. McFadyean recorded a case in the ox in 1900.

The above extract from our leading authority, pointing to the rarity of this skin affection, leads me to record the following definite outbreak, without reference to the literature that may be available on the subject in our periodicals. The various mange mites are an extremely interesting group, but their more minute particulars are more to the zoologist than the busy practitioner.

The following table, however, shows their classification :—



The above table shows the position in Nature of the three common genera of mange parasites and also that there are four distinct species of sarcopt, each possessing well-marked specific characters.

S. lævis causes depluming scabies of birds. Two sub-species or varieties of this parasite have been described, viz., *S. lævis columbæ* and *S. lævis gallinæ.*

S. mutans causes a scaly condition of the legs in poultry and other birds.

S. minor affects the rabbit and cat; sub-species have been described for each of these animals, viz., *S. minor cuniculi* and *S. minor cati*.

S. scabiei affects man, the horse, sheep, goat, pig, wolf, camel, dog, and ferret. Sub-species have been described for each of these animals thus, *S. scabiei hominis*, *equi*, *ovis*, *capræ*, *suis*, *lupi*, *cameli*, *canis*, and *hydrochoeri*. If sub-specific differences are to be recognized, *S. scabiei bovis* should certainly be added to the list. They are all described in Neumann with the exception of the bovine variety.

History.—The outbreak in question occurred in a herd of milking cows, and had manifested itself every autumn when the animals were housed, and lasted until they were again turned out in the following spring. When the cattle were lying out the lesions seemed to disappear, although it is probable that there always remained an insignificant infection. Seeing that many animals were affected, a scraping was taken, and as the result was positive, the matter was gone into more thoroughly as described below.

Symptoms.—The three classical symptoms of a mange are: (1) Pruritus; (2) eruption; and (3) the parasite. These can be enlarged upon. In the present outbreak it would appear that signs of the disease are few. The pruritus causes the animals to rub, and when scratched with the ends of the fingers there were signs of pleasing irritation. The eruptions varied in size and situation. The commonest seats appeared to be the rump, back of the mammary gland, neck, sides of the neck, back, and dewlap. The presence of the sarcopt is the only reliable symptom, and that is dealt with under another heading.

Lesions.—These were almost the same in the different situations, but differences were shown which were due to a thinner skin, or being in such a position that the animal could easily rub them. Out of fifty-nine animals, twenty-six were affected, and all of these showed lesions on the rump and root of the tail, and some had other parts affected, ten on the posterior aspect of the mammary gland, six on both sides of the neck in front of the withers, three on the middle of the back, one on the withers, and one on the dewlap. It is to be regretted that a photograph of a typical case could not be obtained. The weather was bad on two occasions when it was intended to take a photograph, and now the lesions can hardly be discerned.

The first thing noticed is that the hair is getting scanty and later appears to be gone; examination with the lens shows a crop of very fine hair. Wrinkling then commences, but pressure will remove it, leaving lines or creases. These wrinkles then become permanent, and there is thickening of the skin. Scaly deposits next appear, and these can be removed by rubbing, when a yellow serum-like material is seen. Blood points are visible, but not in great numbers. This description is typical for the lesions of the mammary gland and around the root of the tail. But for other situations the lesions are grosser. No doubt this is due to the thickness of the skin. The usual size of the lesion at the tail was about 9 in. along the vertebræ, and 6 in. across them. Rubbing on the part of the affected animals in some cases considerably increases the appearance of the condition.

Diagnosis.—This offers very little difficulty if properly carried out. A deep scraping is taken from the edge of the lesion or from a spot where the condition seems to be active. Superficial scrapings are

often misleading and contain few and sometimes none of the parasites. The scraping is placed in a test tube and covered by an inch or so of a 10 per cent. solution of caustic potash in water. After some hours all the scales will have left the parasites, and examination of a little of the sediment under the $\frac{2}{3}$ in. lens will reveal the acari. This is done, either between two slides, or better still, in a small flat glass dish, such as half a Petri dish, or a watch glass. Preparations from the rump, mammary gland, back, withers, neck and dewlap, examined in this way, revealed the characteristics of the sarcopt. A photograph of the sarcopt could not be obtained. The specimens usually seen were eggs, embryos, larvæ, and females, pubescent or ovigerous, but males were very rare. In one case, Mr. A. L. Sheather, M.R.C.V.S., Demonstrator of Pathology at the Royal Veterinary College, London, kindly confirmed the diagnosis. The females appeared to be intermediate in size between the sarcopt of the pig and that of the horse, when compared with specimens in my collection.

Course, Duration and Termination.—An interesting point is that the lesions increased in size very slowly, and seemed almost to disappear when the animals were at grass, so that it made very little serious headway from year to year. It is quite possible that the conditions of housing in winter are very suitable for the parasite. In the first place there would be a nice warm and even temperature, unattended by cold winds and rain such as would be experienced whilst the animals were grazing. The condition has been seen in the herd for at least seven years, and it seems about the same to-day as then. In the meantime there have been sales and purchases. The condition has not been treated with a serious idea of eradication, and its slow course seems to indicate that were this done the termination would be satisfactory.

Etiology and Contagion.—There is little doubt that the condition is caused by a sarcopt which lives on the ox, and is not a wandering parasite of one of the other animals, or the disease would not have been seen on so many animals, or extended over so long a period. The beasts in question are well tended, and before milking the udders are washed in a suitable agent; they are also groomed; these two acts may spread the disease. It is possible that the process of "riding" as seen in cows in œstrum may play some part in the process of spread, but this was not evident when it was remembered that the condition was slight when the animals were at grass.

Transmissability.—No other animals on the farm were affected, but it was said that in winter the same condition had been seen on the hands of the attendants, the parts affected being the folds of skin at the wrists, knuckles, and between the fingers. The condition was said to be scaly, and with marked irritation.

Treatment.—As the lesions were slight, and great inconvenience would have been caused by treatment during the busy farming season, this has been postponed until the animals are again housed.

THE INFLUENCE OF TEMPERATURE ON MILK YIELD.

BY GEO. H. WOOLDRIDGE, F.R.C.V.S., ROYAL VETERINARY COLLEGE, LONDON.

IT is generally believed by veterinary surgeons and farmers that cows kept during the cold weather in buildings at a comparatively high temperature give a better yield of milk than those kept at a comparatively low temperature. The temperature which is regarded as being most favourable is from 60° F. to 63° F., while in one of the leaflets issued by the Board of Agriculture the temperature recommended is from 55° F. to 60° F. These ideas are based on a fairly accurate physiological basis, for at lower temperatures a certain amount of the food material which would otherwise be utilized in the production of milk is required for heat production, while at higher temperatures, on the other hand, there is a considerable loss of moisture from the skin and a reduced milk production. The method, however, by which farmers generally have sought to obtain the required temperature in winter is open to severe criticism, for the object has been attained by sacrificing ventilation. As most byres are at present constructed one must either sacrifice an adequate supply of fresh air for temperature, or provide plenty of fresh air with a consequent fall of temperature. No doubt, if artificial heating could be introduced so that an ample supply of pure fresh air could be introduced without reducing the temperature of the byre, the maximum amount of milk could be produced along with a proper balance of health. Under present conditions one of the most obvious essentials of health is sacrificed, and instead of being supplied with pure fresh air in winter a very large proportion of dairy cows are made to breathe air very highly polluted, and which has been inhaled and exhaled already. It is small wonder that cows often fall away in condition and in milk yield on being tied up in the autumn. It is generally thought that the change of diet is solely responsible for this, but it is highly probable that the supply of polluted air in the place of fresh air is an important contributing cause. The advantages of efficient ventilation and of fresh air to the health of human beings is too well established to be disputed. The fact that horses are able to work more freely and maintain better health if kept in good, well-ventilated stables is also admitted. One wonders how the fallacy concerning cows has held its ground so long, and it is really little to be wondered at that tuberculosis of dairy cows is so common, seeing that they are so frequently kept under conditions particularly favourable for its spread and development.

Of late a number of experiments have been carried out with a view to ascertaining the effect of dairy cows kept in a warm byre and comparing with cows kept in cool byres. The general conclusion is that warmth is not so beneficial as was supposed, and that cows kept cool do not suffer as they were expected. Experiments have been conducted on fattening bullocks by the Pennsylvania State College, and in England at the Harper Adams Agricultural College, Newport, Salop, with dairy cattle, and the results decidedly support the views expressed above.

The most comprehensive series of experiments, however, has been conducted under the supervision of Mr. John Speir, of Newton, on behalf

of the Highland and Agricultural Society, assisted financially by the Board of Agriculture. The *Transactions of the Highland and Agricultural Society of Scotland*, vol. xxi. (1909), just published, contains a long and detailed account of these experiments conducted on a hundred cows. An adequate account cannot well be given here, and we recommend all interested in this most important subject to obtain a copy and read for themselves. It would seem as though almost all possible precautions have been taken against errors creeping in. The whole work has been a colossal one, and should lead to a change of our systems of housing dairy cattle in winter. Mr. Speir, in closing his description of the experiments, draws conclusions which are appended hereto, and which obviously merit very serious consideration. He says: "The following are the conclusions which it would seem reasonable to draw from this experiment at this stage:—

"(1) That fresh air is a much more important factor in the production of milk in midwinter than it is generally considered to be by milk producers in this country. While most people agree to the need of fresh air in regard to the health of the animals, it seems almost as desirable in mid-winter if a full supply of good wholesome milk is to be produced.

"(2) In order that the greatest advantage may be derived from the fresh air, the animals should at no time have the ventilation restricted in autumn, but should be kept as cool as possible, so that they may not only retain all their hair, but if necessary increase it.

"(3) There is no difficulty, much less impossibility, in producing milk in freely ventilated byres in the coldest weather likely to be met with in this country, if the cows are freely ventilated and kept sufficiently cool in early autumn.

"(4) While the present experiment shows that rather more milk has been produced under conditions of free ventilation than where ventilation was restricted, it would be injudicious, till these results have been corroborated by other trials, to consider that this will invariably happen. It is unquestionable that the general health of the cows would be better under free than under restricted ventilation.

"(5) Milk produced in a building kept at a high temperature, or during a warm period, does not seem to be any richer in fat than that produced at a low temperature or during cold weather.

"(6) It seems hopeless to expect to be able to keep the air of any byre, no matter how the byre may be constructed, at from 60° F. to 65° F. during the ordinary weather of an average winter without excessive pollution of the air.

"(7) While the effect of a high or a low temperature is probably felt by animals almost instantaneously, and very likely to produce its results at once, we have little information indicating how long a cow may breathe a vitiated atmosphere before that effect shows itself on the animals or their production of milk. At Newton the influence seemed to show itself between the fourth and fifth week after the experiment began.

"(8) The great causes of the variation of the fat in milk are:—

"(*a*) Irregularity in the hours of milking.

"(*b*) The individuality of the cow.

"(*c*) Want of perfection in milking.

" (9) Any saving in food which is effected by keeping the animals at a higher temperature is equalled, if not exceeded, by improved digestion when they have plenty of fresh air but a lower temperature.

" (10) There is reason for believing that those great scourges of the dairyman—mammitis, or weed, and tuberculosis—may be reduced to a minimum if cows are kept in freely ventilated byres in winter."

FOODSTUFFS AND THEIR DETERIORATION.

BY CAPTAIN H. GAMBLE, F.R.C.V.S., A.V.S., CAHIR, CO. TIPPERARY.

Definitions of Food.—(1) " Food may be defined as anything that will nourish the animal body: it is any solid or fluid material taken into the system to be utilized for growth, nourishment, development, &c."

(2) " That which, being innocuous in relation to the tissues, is a digestible, absorbable substance that can be oxidized in the body, and decomposed in such a way as to give up to the body the forces it contains."

These two definitions embrace the whole of the uses of food to the animal body, but it may be added that the food ingested by an animal is also used in the manufacture and elaboration of that animal's natural secretions, as, for example, for the production of milk, for the nourishment of the offspring until it becomes able to obtain its food supply independently.

In the second definition it is pointed out that food must be innocuous in relation to the tissues; and the objects of this paper are to describe some of the means by which animal foodstuffs are rendered nocuous, or harmful, by deterioration, and an attempt to describe some of the processes of deterioration.

Definition of Deterioration.—By deterioration is meant any process which reduces the nutritive value of the food, or renders it in any way harmful to animals feeding upon it.

Deterioration, in the sense in which it is used in this paper, is not intended to include falsification, although this falsification is necessarily a form of deterioration; for example, the fraudulent mixing of linseed cake with linseed meal, the former containing only 9·6 per cent. of digestible fat and the latter 35·2 per cent., the mixture being sold at the same price as linseed meal, which in fact and in substance it is not.

" Falsification is in principle all modification of the normal composition of a commodity destined for sale, unless the buyer is expressly forewarned." (VETERINARY JOURNAL, March, 1909.)

Deterioration processes may occur at various times during the life of the plant, *i.e.*, the seed may be attacked before germination, during germination, when planted in the soil, or as a crop after the seed has germinated.

In this section it is proposed to describe some of the processes of deterioration of foodstuffs after the crops have been cut and are no longer living. For convenience of description, the parasites which are the causes of this deterioration may be divided into vegetable and

animal, and, in addition to these, chemical and mechanical agencies must be considered: (*a*) During the preparation of the food, as, for example, hay-making and the preparation of ensilage; (*b*) during storage, as, for example, the effects of dampness, heating, and "sweating."

(*a*) During the process of hay-making there are many ways in which deterioration may, and does, occur, and the more common may be briefly described as follows:—

Overgot Hay.—By this is meant that the grasses have not been cut until they have become over-ripe, with the result that the fibres become woody, hard, and indigestible, the flowering heads have run to seed, and the hay therefore possesses less aroma, and is less palatable.

Weathered hay has been left out too long before being carried. Sometimes this may be due to bad weather, when there is not enough sun to dry it properly, and it lies and soaks, and, if left long enough, turns black, gets musty and mouldy, and may even rot.

Mowburnt Hay.—This condition occurs when the hay is stacked too soon after being cut, *i.e.*, it is stacked before it has been allowed to dry on the ground, with the result that it heats in the stack.

Ensilage.—This is prepared from almost any green grass crop, *e.g.*, clover, grasses, rye, green cereal crops, vetches, peas, beans, &c. The grasses must be cut before they are ripe, while they are green and succulent. There are two kinds of ensilage prepared—sweet and sour.

Sweet ensilage is made by packing one of the above-mentioned crops tightly in an air-tight compartment or silo, which allows the temperature of the mass to rise high enough to kill all the ferments. The rise in temperature is brought about by the oxygen permeating through the tightly packed mass and combining with the carbon of the fodder, forming carbonic anhydride. After this as much pressure as possible is employed to exclude the air and keep down the temperature.

Sour Ensilage.—In this case the temperature has not risen high enough to kill the ferments, *i.e.*, it has not risen as high as 120° F. to to 122° F. Oxygen has not been taken in to combine with carbon, the result being that the ferments produce small quantities of lactic, butyric, and alcoholic acids.

Sweet silage appears to be a better food than sour. It contains about ·01 per cent. of volatile acids (acetic, &c.), and ·13 per cent. of fixed acids (lactic acid, &c.). Sour silage contains ·32 per cent. of volatile and 48 per cent. of fixed acids.

The silo should be constructed with smooth walls, so as to allow the mass to settle easily, keeping it as free from air as possible, otherwise the outside of the mass, for a few inches in depth, may become quite worthless, owing to the formation of carbonic anhydride, *i.e.*, oxidation.

(*b*) *During Storage.*—More particularly the storage of grain. It must not be stored damp, otherwise it will probably germinate, and also favour the growth of organisms. Heating also favours germination and fermentation, and when sweating occurs moisture is given off from the mass of grain, which collects on the surface of the individual grains and forms an excellent medium for all kinds of organisms to grow in.

Animal parasites of the Acari (a sub-class of the Arachnoidea), which attack and destroy grain; amongst others, the two chief genera are *Gamasus* and *Argas*, which are most destructive, for besides reducing the grains to powder they also render them unfit for food by defæcating upon them as they pass over them. These parasites may best be seen by putting some affected grains upon a piece of black paper in warm sunlight, when they may be seen, by the aid of a magnifying glass, moving about. There are two smaller animal parasites which, in their turn, attack these Acari, without in any way injuring the food, and these are *Psocus pulsatorius* and *Psocus veloce*.

Gamasus tenerum, and the two species of *Argas* (the small yellow and the small white) cause intense pruritus when they come in contact with horse's skins.

Acarus farinæ, the meal-mite, is found contaminating damp meal and flour. This parasite is rather like the *Acarus scabiei* (*Sarcoptes scabiei*) in appearance, but may be readily distinguished from it by the size of its body and legs. The body of the mange parasite is rounded, and its legs are quite thick at the body end, and become quite thin and tapering at the other, whereas the body of the meal-mite is longer, more oval, and its legs are about the same thickness throughout their length.

Other parasites in this connection include *Tenebrio mollitor*, which attacks and infests forage, and *T. farinæ*, which is found in grain. The *T. farinæ* does more damage than the *T. mollitor*, as the larvæ of the former live in the flour; but the larvæ of the latter do not live in the forage, but in the ground. Another is the *Ptinus fur*, the larvæ of which also live in the food, and are most destructive.

The weevils and bruchi attack living crops, but they are also found in stored grain, to which they do considerable injury.

Vegetable Parasites.—In this connection some experimental investigations were carried out whilst I was undergoing a post-graduate course at the Liverpool University, with the following objects:—

(1) To find out what micro-organisms are commonly present in ordinary animal foodstuffs, and what effects, if any, they exert upon them, by rendering them less nutritious or even harmful; or to find out if the micro-organisms had any beneficial effect upon them.

(2) To find out to what extent the known pathogenic organisms occur in foodstuffs, either normally or by accidental contamination, and how these pathogenic organisms invade the animal body.

(3) What steps may be taken to render fodder innocuous, without affecting its nutritive qualities and palatability.

These experiments were carried out by using measured quantities of certain ordinary food materials, which were pounded or crushed with a pestle and mortar, and then mixed or diluted with a certain measured quantity of either sterile water or sterile salt solution. In some cases the substance to be examined was centrifugalized, and the deposit thrown out used to inoculate the media; in others the supernatant fluid was used, and sometimes the platinum loop was just dipped into the prepared material just as it had been mixed.

The media used were ordinary agar-agar, gelatine slants, potato slants, Petri dishes containing agar-agar, bile salt agar, or gelatine broths, and the following sugar media: Cane sugar, mannite, glucose, and lactose, and bile salt and dextrine sera.

The method of procedure was as follows: After sterilizing the platinum loop in the ordinary way by flaming it, the loop was then put into the prepared foodstuff, one loopful taken up, and inoculated on to or into one of the above-mentioned media. In the case of an agar-agar plate, a gate was usually drawn or the medium just touched in five places. In certain cases the agar-agar was inoculated before the plate was poured, the procedure being as follows: The agar-agar tube, after being melted, was allowed to cool to just below 40° C., when it was rapidly inoculated and poured at once into the Petri dish. By this means isolated colonies were obtained. In the case of a liquid medium, such as broth, or one of the sugar media, the loopful was just washed off in the medium, and the cotton-wool replaced in the test tube. These inoculated agar-agar plates and sugar media were then usually put in the incubator at 37° C., and allowed to incubate for twelve hours. The gelatine plates were incubated at a temperature of about 20° C., and were usually left for from twelve to seventy-two hours, being examined from time to time to see how the colonies were growing.

Several sugar media were also cultivated anaerobically, as follows: A layer of cotton-wool was placed at the bottom of an American screw-down bottle, with a rubber joint, and some pyrogallic acid dusted all over it, about 3 in. deep; the inoculated media then placed in the jar, an excess of 10 per cent. caustic potash solution poured into the pyrogallic acid, and the jar immediately sealed and placed in the incubator.

After the plate media had been incubated for twelve hours, they were first examined to count the colonies, which were also generally examined under a low power. Having done this, the next step was to find out what organisms made up the different colonies. To do this, ordinary glass slides were carefully cleaned with filter paper, burned in the Bunsen flame, and allowed to cool. The platinum needle was then flamed, a drop of distilled water taken up with the loop and placed in the middle of the slide, the loop again flamed, and one of the colonies just scratched to remove a small portion of it, which was then dipped in the small drop of distilled water on the slide and a smear made. The smear was then allowed to dry in the air, fixed either by the flame or by alcohol, and then stained and examined under the microscope, usually under one-twelfth oil immersion for bacteria, and one-sixth for moulds. The stains used were the following. Simple stains: Watery eosin (1 in 1,000), carbol-fuchsin (dilute), methylene blue, and Bismarck brown. The compound stains used were Gram and Loeffler's blue.

For the examination of moulds several means of preparing them were employed. Several attempts were made to obtain impression preparations, by carefully lowering a cover-slip into the mould colony, and then pressing it on to the colony with a needle. The coverslip was then carefully taken up, put in absolute alcohol for from five to ten minutes, then in 2 per cent. acetic acid for two minutes, washed in water, and stained, but no good preparation could be obtained, as the mould left very little impression upon the smooth surface of the glass, and did not take the stain at all well. The best preparations were made by picking off some of the hyphæ from a mould colony with needles, teazing them out on a slide in caustic potash solution, and

then lowering a coverslip on to the hyphæ. This preparation was then stained by putting drops of the stain, by means of a platinum loop, between the cover-slip and the slide, and allowing it to percolate under; by these means good preparations were made.

The first foodstuff examined was a sample of linseed cake obtained from the University:—

TABLE I.

Date, 1909	Material	Amount used and how prepared	Amount inoculated	Medium	Growth	Microscopic examination
Feb. 7	Linseed cake	1 c.c. diluted with 10 c.c. of sterile salt solution	One loop	Agar-agar plate	Three colonies:	
					(*a*) Thick, pale yellow, well defined	Large bacilli
					(*b*) Thinner, more diffuse, not so well defined	Much smaller bacilli than (*a*)
					(*c*) Thick, pale yellow, well defined	Also small bacilli

The thick pale yellow colony (*a*) was found to consist of large anthracoid bacilli, arranged in short filaments, generally about four or five end to end. When a hanging drop was examined, these were found to be non-motile. The thinner, more diffuse, colony (*b*) consisted of very much smaller and more numerous bacilli, also arranging themselves end to end. (*c*) Also showed small bacilli scattered about the field, singly, and several lying together, but not end to end. These were all stained with dilute carbol-fuchsin.

The next experiment was carried out with a sample of cotton cake, also obtained from the University.

TABLE II.—EXPERIMENTS MADE ON FEBRUARY 8, 1909.

Material	Amount used and how prepared	Amount inoculated	Medium	Growth	Microscopic examination
Cotton cake (*a*)	20 grammes mixed with 100 c.c. of sterile water, and the mixture strained through wire gauze	One loop of this strained fluid	Agar-agar plate	Thick and diffuse colony in the centre of the plate	Numerous small bacilli
The same (*b*)	The same, but with 10 c.c. of normal saline solution added	One loop	Agar-agar plate	Thick, yellow, well-defined colony on one side of the plate	Larger bacilli

In (*a*) the bacilli were of two kinds, one actively motile, the other non-motile. Three or four arranged end to end, others singly.

In (*b*) the bacilli were larger and longer than (*a*) and arranged in long filaments of seven or eight end to end, the filaments crossing each other. These were non-motile.

TABLE III.—EXPERIMENTS MADE ON FEBRUARY 11 AND 12, 1909.

Material	Amount used and how prepared	Amount inoculated	Medium	Growth	Microscopic examination
Crushed maize, said to be pathogenic	15 grammes pounded up, and mixed with 100 c.c. of sterile salt solution	1 c.c.	Agar-agar plate	Profuse all over the plate	Numerous large bacilli
Same	Same	Three loops	Agar-agar plate	Ten mould colonies	The moulds were Mucor and Penicillium
				Three small well-defined yellow colonies	The three yellow colonies were yeasts
				One yellowish colony	The yellowish colony consisted of large bacilli and spores.
Same	Same	One loop (gate)	Agar-agar plate	Eighteen small well-defined colonies.	These were all yeasts
				Two diffuse colonies	
				One white, well-defined colony	
Same	Same	Three loops (gate)	Agar-agar plate	Profuse growth all along the lines of the gate, and four small, well-defined yellow colonies	The profuse growth along the lines of the gate consisted of short, thick, sporulating bacilli, and the small, well-defined colonies of minute chromogenic bacilli, mostly single, not arranging themselves in filaments
Same	Same	Two loops	Glucose	Four large rounded, whitish moulds	The moulds were Mucors, and showed a mass of hyphæ with sporangia
					Another preparation teazed out showed hyphæ in shreds, and numerous conidia
					No bacteria
Same	Same	Two loops	Mannite	Four moulds	Hyphæ and conidia of *Penicillium glaucum*
					No bacteria
Same	Same	Two loops	Cane sugar	Six large woolly-looking moulds	*Penicillium glaucum* and *Aspergillus glaucus* (*urotium*)
					No bacteria
Same	Same	Two loops	Dextrine serum	Very numerous small colonies	Small bacilli with spores

TABLE IV.—EXPERIMENTS MADE ON MARCH 3, 1909.

Material	Amount used and how prepared	Amount Inoculated	Medium	Growth	Microscopic Examination
Decorticated cotton cake. Sample from the University	15 grammes powdered and made into a paste with 30 c.c. of sterile water	One loop each	Two gelatine plates	Two small colonies on one plate, and one small colony on the other on Mar. 6, 1909	Of the two small colonies one consisted of numerous staphylococci, with a few thin non-sporulating bacilli, the other of staphylococci only The one colony consisted of numerous small bacilli, some sporulating, and mostly lying singly
Same	Same	One loop	Agar-agar plate (gate)	Profuse along line of gate. Diffuse growths, some whitish in colour, others same colour as medium	Whitish colony consisted of micrococci, some single and others arranged rather like sarcina. The other consisted of short non-sporulating bacilli
Same	Same	One loop in each test-tube	Hot agar-agar poured into two Petri dishes	Profuse growths all over both media consisting of large diffuse colonies, and smaller, thicker colonies	The larger diffuse colonies were made of up short thick bacilli, with truncated ends, non-sporulating. Smaller thicker colonies of longer bacilli, arranging themselves in long filaments; these were non-motile
Same	Same	One loop	Glucose	Markedly acid reaction: medium turbid. Some gas formation	Mixed culture of cocci and bacilli (sporulating), cocci predominating
Same	Same	One loop	Cane sugar	A good deal of gas formation: Medium turbid, bubbles on the surface	Mixed culture of cocci and bacilli, the latter predominating
Same	Same	One loop	Mannite	Medium turbid. Marked acid reaction	Very large bacilli arranged in long leptothrix filaments, and larger, thinner, smaller bacilli, not in filaments
Same	Same	One loop	Litmus milk	Acid reaction	Very large bacilli, scattered about the field
Same	Same	One loop	Dulcite sugar	Alkaline reaction. Medium slightly turbid.	Mixed culture of a few large and a few small bacilli

TABLE V.—EXPERIMENTS MADE ON MARCH 3, 1909.

Material	Amount used and how prepared	Amount inoculated	Medium	Growth	Microscopic examination
Decorticated cotton cake. Sample from the University	15 grammes powdered up and mixed with 30 c.c. of sterile water	One loop	Glucose	Medium turbid, numerous small, minute colonies, and either a mould or zooglea mass on the surface of the medium; a little gas	Short, thick, "stunted" bacilli, and longer, thinner rods, scattered sparsely over the field; the zooglea mass was bacillary
Same	Same	One loop	Cane sugar	Tube nearly filled with gas; medium slightly turbid, with very minute colonies	Many small, thin, non-sporulating bacilli
Same	Same	One loop	Dextrine serum	Medium coagulated, would not pour; zooglea mass growing on the surface; the medium was coagulated so that the test tube could be held upside down; the coagulum was of the consistency of vaseline, and offered no resistance to the needle	Large anthracoid bacilli in long filaments and crossing and recrossing in masses; an agar-agar slant was inoculated from this on March 6, and the colonies closely resembled an impure culture of anthrax
Same	Same	One loop	Litmus milk	Medium half coagulated	Large anthracoid bacilli and longer, thinner bacilli, and also numerous cocci, apparently diplococci; both kinds of bacilli and cocci were Gram positive
Same	Same	One loop	Dextrine serum	No gas; medium turbid, with numerous small colonies	Some small bacilli, and others longer and thinner

In the experiment detailed in Table III. a sample of maize was examined which had been fed to cattle, and was said to be the cause of gastro-enteritis, one case ending fatally.

In the cultures from this maize grown on agar-agar, from the first amount inoculated (1 c.c.), there were large non-motile bacilli, so that the very large amount of moisture probably favoured the growth of schizomycetes (bacteria), the hyphomycetes (moulds) preferring a drier medium. The next agar-agar plate inoculated with only three loops of the platinum needle, grew ten mould colonies, three colonies of saccharomyces (yeasts), probably *Saccharomyces flava*, and only one colony of large bacilli with spores, while on the third plate, with only one loopful, all the colonies were yeasts, and again on the fourth plate, with three loops, there were bacilli only.

Anthracoid Bacilli.

In this maize experiment (see Table III.) moulds predominated, and there were comparatively few bacteria. Both in the mannite medium and the cane sugar and glucose, none could be observed, though in the dextrine medium small bacilli with spores were fairly numerous. From this medium an agar-agar slant was inoculated, the medium being first poured into a Petri dish, and twelve hours afterwards there was a profuse growth all over the medium, which showed the same small sporulating bacilli, and a few larger bacilli. A bile salt agar was also inoculated from the same dextrine in the same way, which, being a very selective medium must have inhibited the growth of these organisms, since none could be detected even after twenty-four hours' incubation. No yeasts were obtained. All these media were cultivated anaerobically.

The most curious feature of the experiment shown in Table IV. was that the large bacilli from the mannite showed an arrangement closely

resembling that of anthrax bacilli, and were stainable by Gram (see photograph). From this two agar slants and another mannite were inoculated, and cultures on both slants closely resembled anthrax colonies, and in smears stained by Gram and examined under the microscope the individual rods very much resembled anthrax bacilli, and were arranged in leptothrix filaments. No organisms could be detected in the mannite medium, smears being stained from it, both with dilute carbol-fuchsin and methylene blue. Several cultures were made of this organism, in order to obtain a pure culture, but without success, and on March 22 two rabbits were inoculated with an emulsion of the impure culture in broth, by Professor Williams, but with no result. The rabbits were destroyed on March 27, and both showed slight hæmorrhagic infiltration and slight emphysema at the site of inoculation.

In the experiment shown in Table V. all the media were cultivated anaerobically. Again, in both the dextrine serum and litmus milk the same Gram positive anthracoid bacilli were found. Two agar-agar slants were inoculated from the litmus milk on March 5, and there was a good growth on both on March 6, both showing the same anthracoid bacilli, stained by carbol-fuchsin. A hot agar-agar was also inoculated and poured into a Petri dish, and on March 6 there was a profuse, mixed growth all over the medium, some of the colonies very closely resembling anthrax when examined under a low power.

The clinical history of the sample of hay (see Tables VI. and VII.) is as follows:—

It was sent to the Liverpool University by a veterinary surgeon, whose client stated that several cows on his farm had been taken ill, and that two had died. *Post-mortem* examination revealed catarrhal gastro-enteritis. The symptoms were loss of appetite, staring coat, and colicky pains, a rise of temperature and injection of the visible mucous membrane. The moulds in this experiment (Table VI.) predominated, and it is conceivable that the symptoms induced in the cattle may have been due to an intestinal mycosis. A potato medium was inoculated with the mould from the cane-sugar medium, but would not grow, since there was a very profuse growth of large and small bacilli all over the potato, which probably choked the mould.

In the second hay experiment (Table VII.), after another 100 c.c. of sterile water had been added (300 instead of 200), not a single mould colony grew on or in any of the media, nor were there any yeasts. All the sugar media were cultivated aerobically in the ordinary way in the incubator, whereas in another experiment, with exactly the same quantity of water and one loop of the platinum needle, when the media were cultivated anaerobically moulds were again present.

In an experiment with oats (see Table VIII.) the moulds which grew in the lactose and dextrine serum were put in 5 per cent. caustic potash solution, and left there all night, with the result that they disintegrated when an attempt was made to take them out from the watch-glasses on a needle for examination. In this experiment both moulds and yeasts were very numerous, and considerably predominated over the bacteria, of which there were very few. The oats were hard, clean, and an ordinary fair sample of white oats.

In the *Journal of Comparative Pathology* (vol. xvi., December 31, 1903), there is described a case of gutturomycosis in a horse, the cause of which was directly due to the *Aspergillus fumigatus*. The

TABLE VI.—EXPERIMENTS MADE ON MARCH 6, 1909.

Material	Amount used and how prepared	Amount inoculated	Medium	Growth	Microscopic examination
Hay said to be pathogenic	One handful broken up with pestle and mortar with 200 c.c. of sterile water, and the liquid centrifuged (20 c.c.) in two tubes of 10 c.c. each	One loop from centrifuged deposit	Agar-agar plate	Profuse all over the medium of both moulds and bacteria	The thicker, whitish colonies showed small ovoid sporulating bacilli, and larger bacilli, some of them arranged in filaments. Thinner colourless colonies consisted of smaller bacilli, generally arranged in small groups and not in filaments. The larger bacilli were Gram positive, the smaller the reverse
Same	Same	One loop	Cane sugar (alkaline)	Acid reaction. One large mould colony	A smear-stained carbol-fuchsin showed a small number of large and smaller bacilli in filaments. The mould was inoculated into potato, but did not grow.
Same	Same	One loop	Dextrine serum (acid)	Acid reaction. Medium coagulated. One large mould growing all over the surface of the medium	The mould was a Mucor, and a smear from the medium-stained carbol-fuchsin showed long anthracoid bacilli, arranged in long filaments
Same	Same	One loop	Litmus milk (alkaline)	Acid reaction. Medium coagulated. Large mould covering the surface of the medium. Under the mould a solid brick-red mass, and under this again the turbid watery fluid of the medium	The mould was a mixture of Penicillium and Mucor, the stigmata and conidia of the former and large sporangia of a Mucor could be distinctly seen. The thick red mass showed a few large bacilli. The liquid part showed thick short Gram-positive bar bacilli
Same	Same	One loop	Glucose (acid)	Acid reaction. Gas formation. Medium slightly turbid.	Bacilli, and a yeast resembling *Saccharomyces albicans*. A few micrococci
Same	Same	One loop	Lactose (acid)	Acid reaction. One large mould	The mould was a Mucor. No bacteria, only *débris* of hyphæ
Same	Same	One loop	Mannite (alkaline)	One large mould. Very little gas. Alkaline reaction. Strong odour of putrefaction and medium slightly turbid	The mould was a Mucor. Thick, short bacilli and staphylococci were seen in a smear of the medium-stained carbol-fuchsin

TABLE VII.—EXPERIMENTS MADE ON MARCH 10, 1909.

Material	Amount used and how prepared	Amount inoculated	Medium	Growth	Microscopic examination
Hay said to be pathogenic (same as before)	One handful pounded up, with 300 c.c. of sterile water and two 10 c.c. tubes centrifuged	One loop of centrifuged deposit	Agar-agar plate	One large profuse colony and several smaller ones, three resembling moulds, fifteen small, rounded, yellowish colonies, triangular shaped colony at edge of plate, and a rather large, thick colony	The large, profuse colony showed numerous small sporulating bacilli; the small round colonies showed larger bacilli; the white colonies showed a mixture of large and small bacilli, some sporulating; the triangular colony consisted of small, non-sporulating bacilli, and the thick colony of numerous small, non-sporulating bacilli
Same	Same	One loop	Gelatine plate(gate)	Growth along all the lines of the gate, apparently fairly pure; medium liquefied in places	Small bacilli, stained carbol-fuchsin
Same	Same	One loop	Glucose (acid)	Gas formation, acid reaction; medium lighter in colour, slightly turbid; no moulds	A few longish bacilli and micrococci
Same	Same	One loop	Mannite (alkaline)	Much gas formation, acid reaction	Numerous small bacilli and micrococci
Same	Same	One loop	Lactose (acid)	Acid reaction, gas formation; medium lighter in colour and slightly turbid	Small bacilli and micrococci
Same	Same	One loop	Cane sugar (alkaline)	Alkaline reaction, gas formation	Bacilli and micrococci
Same	Same	One loop	Litmus milk (alkaline)	Alkaline reaction	No bacilli, a few micrococci
Same	Same	One loop	Dextrine serum (acid)	Gas formation, acid reaction	Very few bacillary forms, some of them sporulating

TABLE VIII.—EXPERIMENTS MADE ON MARCH 17, 1909.

Material	Amount used and how prepared	Amount inoculated	Medium	Growth	Microscopic examination
Oats, bought at a corn dealer's	10 grammes pounded and mixed with 50 c.c. of sterile water	One loop of the mixture	Bile salt serum (acid)	Two mould colonies. Acid reaction. No gas formation	The mould colonies were oïdium. There was a yeast
Same	Same	One loop	Cane sugar (alkaline)	One mould colony. No gas. Alkaline reaction	The mould was a Mucor. Bacilli, cocci, and a few yeast cells
Same	Same	One loop	Mannite (alkaline)	One long, thin mould colony. Alkaline reaction. Medium turbid	Mould showed very fine hyphæ, no sporangia, and could not be distinguished
Same	Same	One loop	Glucose (acid)	Acid reaction. Medium turbid. Slight gas formation	Yeast cells, and a few bacilli
Same	Same	One loop	Lactose (acid)	Large mould covering the surface of the medium. Acid reaction. Gas formation	The mould could not be distinguished. No yeast cell, no bacteria
Same	Same	One loop	Dextrine serum (acid)	Acid reaction. One mould colony	The mould could not be distinguished. No yeast cells, no bacteria.
Same	Same	One loop	Litmus milk (alkaline)	Large mould covering the surface of the medium	Yeast cells and a few bacteria
Same	Same	One loop (gate)	Agar-agar plate	Two large mould colonies, four small mould colonies, and one yellow colony	The large mould was a Mucor, the yellow colony was a yeast

symptoms were such that "the diagnosis vacillated between stricture of the œsophagus, stenosis, impaction, and tumour formation." The animal tossed its head, and ejected quantities of food through the nostrils, attempted to vomit, the attempts were followed by coughing, and the ejection of all the liquid swallowed mixed with pellets of food.

Post-mortem Examination.—On the inner wall of the left guttural pouch was a sharply projecting, white, velvety patch, formed by a fine growth of a very pure mycelium. It was elliptical in shape, the greater length being vertical. It measured 2¼ in. by 1½ in., and was inherent over the insertion of the rectus capitis. On removing this mycelium, a thin, black pellicle was found, which, when detached, revealed a yellowish white magma, fairly firm in consistence, and forming almost the entire thickness of the growth. The rest of the guttural pouch was absolutely healthy. The mucous membrane presented a shiny appearance, and the entrance to the Eustachian tube was closed. Microscopically examined the mycelium appeared entangled, and exhibited dichotomic divisions. Cultures proved it to consist of *Aspergillus fumigatus*. Sections through the thickness of the lesion showed this to consist chiefly of an exudate surrounding four nerve bundles, in a profound state of degeneration, the glossopharyngeal, the pharyngeal branch of the pneumogastric, the hypoglossal, and a part of the superior cervical ganglion.

On microscopic examination the nerve fibres were found partly degenerated, and invaded by a connective tissue new growth, as well as numerous radiating tufts of mycelium. Some cultures produced the *Aspergillus fumigatus* in a state of purity, and others a staphylococcus in addition.

Some of the Diseases due to Moulds (*Mycoses*).—Mycotic stomatitis occurs in calves. This is caused by *Oidium albicans* (*Saccharomyces albicans*), and is not usually serious. It produces a stomatitis, and the eruption may extend to the pharynx and œsophagus, and end fatally by stopping deglutition, but this is rare.

Pneumomycosis.—Occurs chiefly in ruminants, but in other animals as well. This is caused by the inhalation of the spores of *Aspergillus niger* or *A. fumigatus*, and is sometimes known as aspergillosis. The spores are inhaled, and may cause a pneumonia by germinating in the respiratory passages and causing dilatations. *Post-mortem* examination reveals the presence of nodules in the lung tissue, and microscopic examination of the discharge may show the mycelium and spores of the fungus.

Dermal Mycosis.—Melvin and Mohler in the "Report of the Bureau of Animal Industry," 1907 (United States), described a dermal mycosis in horses, caused by the *Fusarium equinum*, in which they consider that the fungus enters the hair follicles, penetrates between the cells of the epidermis, or through an abrasion, and involves the surrounding cuticle, giving rise to great pruritus. This condition they treated with mange and ringworm dressings.

Mycotic Gastro-enteritis.—Generally seen in cattle after the ingestion of mouldy fodder, and is considered to be caused by Mucor, Penicillium, and Aspergillus.

Clinical Articles.

NOTES ON A CASE OF MELANO-SARCOMA IN A MARE.

BY AUSTIN PETERS, M.R.C.V.S.

THE subject in this case was a grey mare, aged 11 or 12, standing 15.3, pulled mane and docked tail. The least interesting feature of the case is that she was the property of the writer; she was purchased by him of a dealer in May, 1908, and was destroyed about a year later in May, 1909.

In considering the case after making an autopsy, it would seem to account for the mare having been in rather poor condition during the time the writer owned her, although she appeared to be in good health until about six weeks prior to the time she was destroyed. That is she had a frame for a horse that should weigh 1,000 lb. to 1,050 lb., yet her weight during the year she was under observation was but about 930 lb.

About the middle of April she seemed to trot a little stiffly behind and a few days later seemed to be stiff in the back and neck when taken out of the stall. She was kept in a stall six feet wide and always turned about and was led out when untied, but when the stiffness appeared she always after that backed out of the stall. As she was ridden under the saddle by a heavy man about the time the symptoms first appeared, it was thought that her back had been sprained in some way and the symptoms ascribed to the results of the ride. As she seemed to feel well and did not show much stiffness at first, she was driven a little for about three weeks, or until about the end of the first week in May, then as she seemed to grow worse she was taken out of work altogether and allowed the freedom of a loose box. When led out on the grass at the time she was laid off, it was with great difficulty that she could get her mouth down to the ground to eat grass, and then only by spreading the fore legs somewhat apart. After a couple of weeks she could not get her nose down to the ground and commenced to stagger behind, going cross legged, like a horse with spinal meningitis, except that she knuckled over a little. She was then put in slings, where she remained for a week, growing gradually worse and finally losing all power in the hind legs; she was then shot.

During the development of the illness various thoughts as to the cause of the trouble suggested themselves, among them melanosis, and pulmonary glanders. When she was first taken out of work she was tested with mallein but gave no reaction. During the progress of the trouble her temperature ranged from 101° to 102° F., and her pulse was usually about 42, strong and of a good character: until within a couple of days of her death her appetite was good, and countenance fairly cheerful; the last two days the expression became anxious.

Autopsy made the day after she was shot showed the mare to have been suffering from melano-sarcoma. There were eleven tumours in the spleen, from the size of a walnut to the size of a cricket ball, there were three tumours in the liver, each about the size of an apple, and in each lung there was a tumour the size of a cricket ball, situated in the large lobe on the superior curvature near the dorsal vertebræ.

When the back was split down the bodies of several of the dorsal vertebræ were pigmented, as were also the bodies of two or three of the lumbar vertebræ, and in the spinal canal in the lumbar region there was a small melanotic tumour about the size of the end of the little finger, elongated in shape, pressing upon the spinal cord, thus accounting for the paralysis of the hind legs. The sixth rib on the near side also showed an area of softening and pigmentation extending through a portion of its body. The heads of the three last ribs on the near side were fractured at the necks. Whether or not this was done at the time she was ridden horseback or later it is not easy to decide, but as the dorsal vertebræ with which these ribs articulated were pigmented, degenerative changes in the bones in contact would account for the brittleness, as two or three of these ribs were also fractured near the cartilages of prolongation, due no doubt to the mare dropping her entire weight into the slings when the loss of power in the hind legs became total; it is not unlikely that all the fractures occurred at the same time, especially as there did not seem to be any process of repair under way at the upper extremities of the ribs. There were also pigmentations in the mammæ.

An interesting feature of the case is that the mare did not show any external indications of melanosis to speak of, as is so common in grey horses. There were only three small nodules on the under side of the dock, each about the size of a pea.

MELANOSIS OF THE PERITONEUM IN A BULLOCK.

BY GEO. H. WOOLDRIDGE, F.R.C.V.S., ROYAL VETERINARY COLLEGE, LONDON.

I AM indebted to Mr. Elton Bell, M.R.C.V.S., Municipal Veterinary Officer of Penang, Straits Settlements, for the specimens here described. In his letter, Mr. Bell says: "The melanotic specimens are from a chestnut bullock, and I should think the case is unique. It was an abattoir case, and I could get no history. The peritoneum only was affected, and after a very thorough examination the carcase otherwise appeared normal."

The specimens consisted of the omentum and spleen of a bullock. They had been preserved in glycerine, and wrapped in cotton-wool soaked in glycerine and then packed in a hermetically sealed tin and enclosed in a box. The omentum arrived in excellent condition under this treatment; the spleen was in fairly good condition also, but glycerine would not appear to be a good preservative for that organ for permanent museum specimens, as the spleen became rather soft and more pulpy. It was, however, in good condition for examination. The omentum presented a very pretty arborescent appearance, almost uniformly affected throughout. A portion was cut off for museum purposes, and a photograph of that portion is here reproduced. The melanotic pigment was deposited immediately beneath the peritoneum, and was not quite so abundant in those portions of the omentum where there was most fat.

The peritoneal covering of the spleen was studded irregularly with patches of melanin. The splenic substance, as may be seen from the incision, shown in the photograph, was not invaded with the pigment.

It is probable that Mr. Bell is correct when he expresses the opinion that the case is unique.

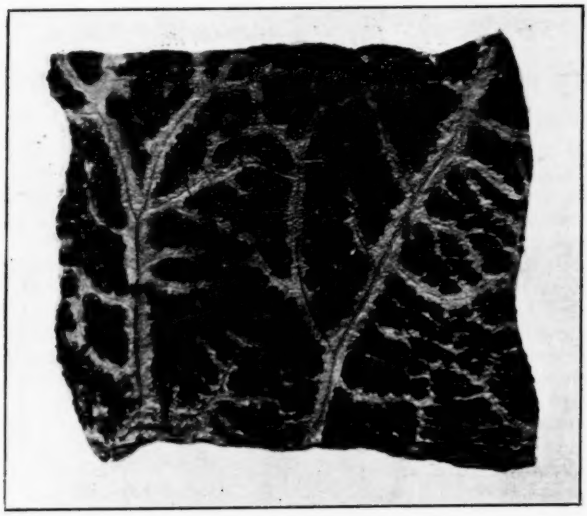


FIG. 1.—Melanosis of the Omentum.

FIG. 2.—Melanosis of Peri oneum covering the Spleen.

FIG. 1.—Bladder of Dog, opened to show Calculus in Position.

FIG. 2.—Lateral view of Bladder.

AN UNUSUAL CASE OF CYSTIC CALCULUS IN A DOG.

BY GEO. H. WOOLDRIDGE, F.R.C.V.S., ROYAL VETERINARY COLLEGE, LONDON.

THE subject of this note was an aged male fox-terrier. He was brought to the College clinic in a state of collapse, and had been unable to pass his urine for twenty-four hours. On examination the bladder could be felt very distended through the abdominal wall, and there was a distinct urinous odour from the skin. The pulse was almost imperceptible, and the nostrils collapsed at each inspiration. The dog was obviously in a moribund condition, and the owner wished him to be chloroformed to death, which was done.

On making a *post-mortem* examination, a very interesting condition of the bladder was revealed. On the lower aspect (fundus) of this viscus, which was full of urine, was a prominence, which proved to be due to the formation of a sac or pouch, in which a calculus had been deposited. On further examination a spherical calculus was found wedged into the neck of the bladder, occluding it. On opening the organ the calculus was removed, and found to exactly fit the pouch in the fundus. The wall of the pouch was simply peritoneum and mucous membrane, the muscular layer having evidently been ruptured. The mucous membrane of the bladder was intensely inflamed throughout its extent. In fig. 1 the bladder is slit along its upper surface, and the interior exposed to show the calculus in the save in the fundus. In fig. 2 a side view of the bladder is shown, the letter P indicating the pouch in which the calculus was developed.

A portion of the calculus was analysed in the College Chemical Laboratory by Mr. Winter. It was noted that it was unusually soft when filing a portion off and that is no doubt accounted for by the large amount of organic matter present. Mr. Winter reports it to contain: Volatile matter (mostly organic), 36·8 per cent.; phosphates of calcium and magnesium, 58·9 per cent.; and traces of sodium, potassium, ammonia, and carbonic acid (percentages calculated on the weight of steam-dried calculus).

PREVENTIVE INOCULATION AGAINST QUARTER-EVIL.

BY S. M., VETERINARY SURGEON, DEVON.

HAVING the management of a practice in a stock-rearing district, in which quarter-evil was more or less prevalent, it was quite necessary to adopt the latest scientific remedy or prophylactic. I can speak with the greatest confidence in respect to the use of Black Quarter vaccine. I quote two simple examples:—

(1) On one farm the owner used to lose fifteen or twenty yearlings and calves every year. Since vaccinating, not a single death has occurred on the farm. The animals are done as early as 3 months and upwards, and only once. The farm is light sandy soil.

(2) On another farm, four years ago, twenty-five were vaccinated, and there were two deaths. Since then all young stock have been treated from 1 month to 3 months old, and revaccinated at the end of six months. No deaths have followed.

On heavy, low-lying farms, where the disease is prevalent, the

above plan should be adopted. Where quarter-evil is prevalent, I advise all young stock from 3 weeks to 6 months to be treated, and revaccinated in six months; then one can almost guarantee absolute immunity. All young stock on the farm should be treated at the same time.

I have also come to the conclusion that deaths are more likely to follow amongst young stock that have changed hands. Preventive inoculation is a great boon to the small farmers, who can now rear their young stock of two or three with safety if adopting this line. All breeds, from the purest to the nondescript, have been treated as above with the greatest of success.

The preparation I always use is Blacklegine, in single form, as supplied by the Pasteur Institute.

AN INTERESTING CASE OF TUBERCULOSIS IN THE HORSE.

BY ALEX. H. TOWNE, M.R.C.V.S., AND FREDK. HOBDAY, F.R.C.V.S., LONDON.

About a month ago a well-bred chestnut hunter gelding was brought under our notice, the owner relating the following history:—

The animal was about 10 years old, and had been in regular work until last Christmas, when it had fallen lame, and after various treatments had failed the actual cautery was resorted to. It was necessary to cast him before this could be done. The owner stated the animal had never been the same since he was cast for the operation. He almost refused all food, and became emaciated, and so was turned out to grass, where he seemed to feed well, but emaciation still continued, and he got worse and worse. After being at grass two months the animal came under our notice, when we observed the following symptoms: There was a decided disinclination on the part of the horse to bend his neck, and when turning round the whole body moved in one piece. Feeding on the ground was only accomplished with difficulty, and there was considerable loss of flesh and emaciation. The neck was markedly stiff and painful. The cervical muscles, too, had now wasted so that the vertebræ "stood out" prominently, and there was a certain amount of pain when pressure was applied over them.

Suspecting tuberculosis, the tuberculin test was applied, and as there was a distinct reaction the horse was killed. *Post-mortem* examination revealed the characteristic ostitis and periostitis in a most marked manner upon every one of the cervical vertebræ, and there were tuberculous lesions in the spleen. All other organs were healthy.

Abstracts and Reports.

EPIZOOTIC ABORTION.

THE following is an abstract from the Report of the Departmental Committee, appointed by the Board of Agriculture and Fisheries, to enquire into the pathology and etiology of the above disease, and to consider preventive and remedial measures.

The Committee consisted of: Sir Edward Strachey Bart., M.P.; the Very Rev. Dr. John Gillespie; Professor Sir John McFadyean, M.R.C.V.S., M.B., B.Sc., Principal of the Royal Veterinary College; Mr. William Hunting, F.R.C.V.S.; Dr. George H. Falkiner Nuttall, F.R.S.; Mr. Stewart Stockman, M.R.C.V.S., Chief Veterinary Officer of the Board of Agriculture and Fisheries. Sir John McFadyean was appointed Chairman, and Mr. R. Jackson, M.R.C.V.S., Secretary.

HISTORY.

That the knowledge that animals may cast their young before the full period of gestation is ancient may be gathered from the reference to abortion in Genesis xxxi., 38, but published information on abortion which may assume epizootic characters is comparatively modern.

Flandrin in 1804 (Nocard and Leclainche), stated that the peasants were so convinced of the contagious nature of abortion that they covered up the fœtus carefully and took it out of the byre through a window, so that no cow could afterwards pass over the same route.

In England the "Complete Farmer" (1807), mentions abortion as contagious, and it has long been looked upon as contagious by many farmers in this and other countries.

In the earlier part of the nineteenth century there were amongst scientists opponents and champions of the theory of contagion. Among the former were Hurtrel d'Arboval (1826), in France, and Youatt (1834), in England. Roloff, quoted by Zundel, in 1871, believed that abortion was due to the entrance of an infectant agent by way of the vagina, and stated that a discharge from the genitals always preceded the act of abortion. St. Cyr, in 1875, believed abortion to be due to an undetermined but specific agent. Lehnert, in 1878, produced abortion in cows by putting the discharges and fœtal membranes from aborting cows into the vagina. This was successfully repeated by Brauer, in 1880.

In 1885, Nocard undertook the investigation of abortion in cows, and in the valuable report published in 1886 he brought forward excellent circumstantial evidence of the contagious nature of the disease. Nocard also submitted the disease to a bacteriological study, without proceeding to the crucial test of attempting to infect pregnant cows with his cultures. The description of the microbes isolated by Nocard (micrococci, isolated, in pairs, or in short chains; and short thick bacilli, isolated or in pairs), does not apply to the microbe isolated at a later date by Professor Bang.

In a report to the Highland and Agricultural Society of Scotland in 1889, Woodhead, Aitken, McFadyean, and Campbell showed that

abortion could be produced in cows and ewes by inserting into the vagina plugs of wool contaminated by the discharge of aborting cows. A cow was also made to abort a living fœtus by subcutaneously injecting her with the discharge from an aborting cow.

In 1897 Bang published the results of a very remarkable study of the etiology of epizootic abortion in Denmark. Bang examined the uterus of a cow which had been slaughtered while showing premonitory symptoms of abortion. He found "between the uterine mucous membrane and fœtal envelopes an abundant odourless exudate—a dirty yellow, somewhat thin, pultaceous material, of a slimy, somewhat lumpy character." He also found the sub-chorial tissue of the envelopes to be very dropsical. In cover-glass preparations made from the exudate and stained with methylene blue, he observed a very small bacterium, apparently in pure culture. Many of the organisms lay free, others were in dense clumps which appeared to have been formed inside cells. He described the organism as a bacillus, the body of which contained one, two, and rarely three roundish or elongated granules which readily took up the stain. The bacilli varied in length, the longest being as long as the tubercle bacillus. They were non-motile, and did not stain by Gram's method. These bacilli were also found in the contents of the fœtal stomach and in blood from the fœtal heart.

Bang concluded from his observations that epizootic abortion ought to be regarded as a specific uterine catarrh determined by a definite species of bacterium. This bacterium was cultivated artificially on a mixture of agar and gelatine, which was first liquefied, and then mixed with half its volume of raw serum. Test tubes containing this liquefied mixture of nutrient materials were sown with the uterine exudate, and immediately solidified in cold water. In these tubes growths appeared in a form which Bang described as typical of the abortion bacillus. His bacillus could not be cultivated on potato, agar slopes, serum-agar slopes, or the surface of solid serum. It grew very sparingly in glycerine-broth, and slightly better in glycerine-broth-serum. In the latter material its growth could be rendered more luxuriant by replacing the air in the flask by oxygen. The peculiar and typical forms of growth described by Bang are particularly referred to and discussed in the appendix, dealing with the biology of the bacillus of abortion; they are mentioned here, however, because at the commencement of our investigation they formed the standard for identification with the bacillus of the Danish disease of any organism which might be isolated from aborting animals in this country.

Bang, in his first report, also supplied experimental evidence that pregnant cows, mares, and ewes could be infected with pure artificially grown cultures of the bacillus which he had isolated.

In another paper read before the National Veterinary Association in 1906, Bang recapitulated his conclusions regarding epizootic abortion, and reported the results of some attempts to produce artificial immunity in non-pregnant animals, that is to say, before putting them to the male. The method adopted was the usual one of repeated inoculation with pure cultures of the bacillus. The experiments were on too small a scale to allow a conclusion to be arrived at, but the results on the whole were rather encouraging.

Method of obtaining Material.

Through the sympathetic co-operation of the Board's Honorary Agricultural correspondents, we were put in touch with a large number of farmers in whose herds the disease prevailed. Many of these gentlemen kindly undertook at the Committee's request to forward material in the shape of aborted fœtuses, fœtal membranes from aborting cows, and cotton-wool swabs containing the discharges from aborting animals. In order that these materials might arrive at the laboratory in as fresh a state as possible, rubber bags in which to pack the material, and sterilized swabs of cotton-wool on which to collect discharges from the genital organs, were distributed amongst those farmers who had consented to assist us.

During the winter months a large proportion of the material arrived in a reasonably fresh condition, so that except in the summer months, there was usually no lack of fresh material from the field with which to vary the strains of experimental virus.

Post-mortem Appearance of Cows affected with Contagious Abortion.

The *post-mortem descriptions* of cows obtained from infected herds in the field, and those experimentally infected at the laboratory are given in detail, and it will be seen that the appearances in both classes of animals were identical. The method of examination adopted was to open the abdomen of the animal immediately after slaughter, ligature the neck of the uterus, cut the organ out, and take it to the laboratory for minute examination. In no case have lesions that could be connected with abortion been found in any organ other than the uterus. The following description may be accepted as typical of a cow's uterus when affected.

Externally the organ seldom shows any departure from the normal, except that it may sometimes appear slightly more distended than one would expect for the period of pregnancy. Very exceptionally, however, slight œdema of the uterine wall is present in the neighbourhood of the neck. On cutting into the organ one finds between the chorion and the mucous membrane a variable quantity of exudate. It is particularly abundant around the cotyledons, and it may extend over the whole surface of the uterus and chorion, but apparently the extent of the area covered by it does not altogether depend upon the length of time the animal has been affected, as is seen by comparing the extent of lesions found in the different experimentally infected animals. The affected area may, in fact, after several months of infection, occasionally be so small that there is a risk of its being passed over. Usually, however, the affected area is considerable. In one case of twin pregnancy, with a fœtus in each horn of the uterus, one horn was considerably affected, while the other was to all appearance healthy.

The exudate is usually of a light brownish-yellow colour, which is possibly due to the chromogenic character of the microbe. Sometimes, however, it is a dark chocolate colour, due probably in some cases to admixture of blood, and in other cases to the oozing of fluid from the muscles of a mummified fœtus. Its consistence varies from that of fluid pus to that of tough dough. Frequently it is so glutinous that it is difficult to remove small portions with a platinum needle. In the

fluid parts one usually finds solid flocculi of varying size. If a portion of fluid exudate be placed in a test-tube and allowed to stand for some hours, it separates into a lower portion of yellow solids, and an upper portion consisting of a dirty-grey liquid. When the exudate is removed from the surface of the uterine mucous membrane the latter shows no macroscopical lesions.

In advanced cases many of the cotyledons are softer than normal, and they may even be pulpy. In such cases the cotyledons have a distinctly yellow, necrotic appearance, but no sign of necrosis is to be found on examining sections of the tissue. This appearance has also often been met with in the membranes of aborted calves sent up from the field. The sub-chorial tissue of the fœtal membranes is in some cases œdematous and has an appearance very like mucoid tissue, but this change is not absolutely constant. In quite a number of cases sent up from the field portions of the chorion have been found thickened and of a leathery appearance. This lesion was also met with in one of the experimental cases.

The fœtus may or may not be altered. Out of nineteen fœtuses taken from experimentally infected animals seven were found in which distinct pathological changes had taken place, that is to say, in 36·8 per cent. The changes in the fœtus seem to depend upon the length of time it has been dead. Although several cases have occurred in which the fœtus must have been dead for a considerable time, in no case in the cow was the fœtus putrefying *in utero*. Apparently if the os uteri becomes open at all, the opening is shortly afterwards followed by expulsion of the fœtus. The fœtus may be quite normal in appearance, and up to time as regards development. Sometimes its tissues are œdematous, and occasionally the œdema is blood-tinged. Not infrequently the only alteration found in the fœtus is dropsy of the abdomen, or it may be, of the chest. The umbilical cord is frequently, though not always, dropsical. Sometimes the fœtus is on the way to become mummified. In such cases the fœtal membranes are closely adherent to it, and when one separates them one removes also what is left of the fœtal skin, exposing a dark brownish-red and distorted mass of bony and muscular tissue in different stages of desiccation. Apparently it does not require a very long time for a dead fœtus *in utero* to become mummified, as in one of the experimental animals a mummified fœtus was found one hundred and thirty-eight days after infection, that is to say, probably not more than three months after its development has been arrested, assuming that the fœtus died a month after the heifer received the infective material subcutaneously.

The *post-mortem* appearances in ewes are, we believe, more of experimental than of practical interest, for, as will be shown in a later report, the disease as it occurs in sheep in the field is quite different from bovine abortion, although pregnant ewes can be experimentally infected with the latter.

The experience of this inquiry has been that, if ewes from one experimental lot were killed in the earlier stages—six weeks to two months—after infection, one often failed to find macroscopic lesions in the uterus, while their fellows, affected at the same time with the same material but left to run their normal course, aborted a month or less before the full term of pregnancy. Indeed, several affected ewes went to full term, when they produced live though weakly lambs, and

bacilli of cattle abortion could be found in the membranes. When present, the lesions found in the ewe do not differ materially from those found in the cow, except that the exudate is more often of a deep chocolate colour, apparently from admixture with blood.

The Microbe of Cattle Abortion.

Morphology.—If a suitably stained preparation made from the uterine exudate of an affected cow be examined under the microscope a large number of white blood corpuscles and catarrhal cells from the uterine mucous membrane can be seen. Between the cells there are numerous small single bacilli, which are mostly of an oval shape; some, however, are distinctly rod-shaped, like the tubercle bacillus, and show one or two unstained areas in their substance. In many places the bacilli are collected into dense groups or colonies. Some of these groups look as if they were bounded by a cell membrane, and give the impression of being contained inside tissue cells. In many cases, however, they look simply like collections of agglutinated bacilli, an appearance which it will be afterwards seen they affect in artificial culture in certain liquid media. Lying amongst the smaller elements of a colony one sometimes sees very large oval elements which take the stain very deeply.

As a rule, the majority of the bacilli are between 1 and 2 μ in length, but many are less than 1 μ. The longest measure about 3 μ. The bacilli are non-motile.

Staining.—They stain admirably with methylene blue or diluted carbol-fuchsin. They do not retain the stain when treated by Gram's method and they are not acid-fast.

Occurrence of the Bacilli in the Fœtus and its Membranes.—In no affected uterus while fresh were abortion bacilli found in the fluids contained inside the fœtal membranes. In the fœtus itself, however, they were frequently, though not always, found in the fluid contents of the stomach.

Abortion bacilli were found in the stomach fluid of the fœtus ten times in nineteen experimentally infected cases, that is, in 52 per cent., and this compares in point of frequency more than favourably with the positive results obtained by examining the stomach fluid of fœtuses sent up from the field, in which only twenty-two out of fifty-one (43 per cent.) showed abortion bacilli.

In the same nineteen experimental cases in cattle the abortion bacillus was never found in the fœtal heart blood, but on one occasion, cultures were obtained from the heart blood of a lamb. On one occasion only was the bacillus found in the peritoneal exudate of the fœtus.

In stained preparations from the mucus present in the fœtal stomach one sees squamous and columnar cells shed from the mucous membrane. Large colonies of the abortion bacillus are seldom met with in this material, but one may see considerable numbers of the single rod elements.

Cultural Characters.—For the purpose of obtaining pure cultures the custom was to thoroughly sear the surface of the intact uterus, open into it with a sterilized knife, and extract the exudate by means of a sterilised platinum scoop. It is from the exudate that the best cultures are obtained. One can, however, also obtain cultures from

the contents of the fœtal stomach. For the collection of the latter material the surface of the fœtal stomach was seared, and its wall pierced by sterilized glass pipettes, into which the fluid was aspirated. Keeping in mind the characters assigned by Professor Bang to the bacillus isolated by him from affected cows in Denmark, we attempted in the first instance to obtain cultures on the artificial media—agar-gelatine + raw serum, and glycerine-broth + raw serum –which he stated to be essential for the cultivation and identification of his organism. According to Bang, when tubes containing agar-gelatine + raw serum are sown with uterine exudate, and incubated, one finds "at the end of from two to four days a great number of very small colonies, which develop only in a definite zone of the tubes. This zone lies half a centimetre (about $\frac{1}{5}$ inch) under the surface of the nutritive medium, and it has a thickness of from 1 to $1\frac{1}{2}$ centimetres ($\frac{2}{5}$ to $\frac{3}{5}$ inch). Colonies are not present either above or below this." Professor Bang goes on to say in this connection, "We had thus not to do with an aerobic bacterium, which would have pushed its growth as far as the surface of the nutritive media, and still less had we to do with an anaerobic form, which would have grown as far as the bottom of the tube. The under-limit of the zone of growth lay exactly where the limit of the growth of an anaerobic bacillus shows itself (the necrosis bacillus, for example). This highly peculiar behaviour of the abortion bacillus towards oxygen made it at once apparent that we had to do with a distinct species, and therefore rendered it in the highest degree probable that there was a causal connection between the bacterium and the disease."

Obviously the peculiar mode of growth which has just been mentioned greatly facilitated our further studies, as we were thereby enabled to recognize the specific bacillus even when it was present in very impure cultures. The colonies are very small, even punctiform, the largest scarcely attaining the size of a pin's head. Their form is roundish, and when slightly magnified their edges seem to be finely dentated.

When describing later the behaviour of his bacillus in liquid cultures—glycerine-broth-serum (raw)—Bang further stated that the growth could sometimes be rendered more luxuriant by bubbling a large quantity of oxygen through the fluid and afterwards sealing the mouth of the flasks. In speaking of the biological characters of his bacillus, he stated that his observations "appeared to show beyond any doubt that for the abortion bacillus in its behaviour towards oxygen there are two optima—first, a degree of oxygen tension in the nutritive medium less than that of the atmospheric air; and, second, the presence in the nutritive medium of a very high oxygen tension, which, however, lies somewhat under 100 per cent. Between these two optima there is an intermediate zone in which the abortion bacillus grows badly or not at all." Further, he stated that with the Danish bacillus the growth in glycerine-broth was meagre, and he apparently failed to obtain any growth on the surface of agar or on potato.

We have thought it necessary to quote the above description at length, because the cultural characters of the bacillus were stated to be specific, and to constitute a standard whereby one might recognise the organism of the Danish disease, and because failure to obtain the typical cultures above described when working with the exudate found

in the English disease was almost invariable. Further, the bacillus which was isolated and proved to be the cause of cattle abortion in England exhibited many biological characters different from those described by Bang in connection with the Danish bacillus. Indeed, those differences were so material that, although we were convinced from the start that we had met in the uterine exudate, at least, with the same organism as that described by Bang in Denmark, resort had frequently to be made to experimental tests on pregnant animals in order to prove that the apparently different forms of organism which we had isolated in artificial culture were capable of producing abortion.

Agar-gelatine-serum (*Raw*).—On agar-gelatine-serum (raw) it was almost invariably found that the growth began as a grey circular cloud almost immediately below the surface of the medium, or the first appearance of growth consisted of a large number of very small isolated grey specks in the thin film of medium on the surface at the circumference of the tubes. The grey sub-surface cloud very speedily spread to the top, especially if some liquid had been expressed from the medium in the cooling process. Very frequently, too, it was found that the first growth appeared in the expressed surface fluid, if such existed. Distinct macroscopic colonies only appeared in the sub-surface layer of the medium, that is to say, below the greyish ring, after a week or more. Frequently, even when there was no surface fluid present, the growth would extend over the surface of the medium as a thick dirty-white layer. Moreover, it was found that certain microbes which were undoubted impurities would sometimes give a growth very similar to that described by Bang as occurring in agar-gelatine-serum (raw) medium. Notably, did it occur to our astonishment that the tubercle bacillus isolated from the uterus of a cow gave a growth absolutely identical with that described by Bang as typical. In fact, from a pictorial point of view, it was the most typical growth obtained. Again, it was found that a totally different microbe which was isolated from sheep in the field, and which has been proved to cause abortion in that species, may, and frequently does, give a growth almost identical with that described as typical of the Danish bacillus of cattle abortion.

Very occasionally it was found that the growth of the abortion bacillus would begin nearly a quarter of an inch below the surface, that is to say, very nearly in the anærobic layer of the tube. In these exceptional cases the growth would not show until after about ten days' incubation. Never was a growth of colonies throughout the medium obtained except when undoubted contaminations were present, and we think that such an appearance in a tube may be taken as a certain sign of the presence of impurities.

This medium (agar-gelatine-serum) for various reasons was found difficult to manipulate, and as it did not seem to have any specific qualities it was discarded, except for the purpose of special observations. It was also discovered later that a solid medium with all the advantages, such as they are, and none of the disadvantages of the above, could be prepared by adding to the agar-gelatine a similar proportion of serum which had been diluted, akalinized and sterilized at a high temperature. Tubes of solid media prepared in this way could be sterilized in the autoclave without the serum undergoing

coagulation. In the solidified condition they can be kept in stock, and they can be liquefied when necessary by simply heating the tubes in a Bunsen flame.

The individual sub-surface colonies vary in size from a pin's point to the head of a large pin, but, of course, the larger ones develop at a later period. The smaller colonies are greyish in colour, but as they increase in size their centres become of a distinct rusty brown. In outline they are circular, and in many cases the margins are dentated. The most distinct character of the abortion bacillus grown in this way is the appearance of the larger colonies, which have a brownish centre, grey outer part and dentated edge.

Agar.—On the surface of agar excellent growths of the bacillus were obtained. In order to get such a growth from the uterine exudate one must incubate the tubes for ten days or more, and for that reason the suitability of this medium was at first overlooked. One can, however, obtain excellent growths on the surface of agar in two or three days by sowing with the culture in the top fluid expressed on the agar-gelatine-serum tubes. After one or two changes from smear to smear these surface cultures grow more luxuriantly. At first the growth appears in the form of tiny dewdrops If the material used for sowing has been only moderately rich in organisms the colonies grow in an isolated manner on different parts of the surface. As they increase in size they develop a faint bottle-green colour, which after a time takes a distinctly yellow, and sometimes a brownish, tint. If the seed material has been rich in organisms a dewy film appears all over the surface. This film also takes on the faint bottle-green tint, and may become yellow or even brown, while a dense greyish deposit of microbes forms in the water of condensation at the bottom of the tubes. At first, as already stated, on account of the apparently great difference between this manner of growth and that of the microbe isolated in the case of the Danish disease, we were inclined to look upon these surface growths as contaminations. That they are cultures of the abortion bacillus cannot be doubted, however, as will be seen later.

Gelatine was found useless for the cultivation of the abortion bacillus, and the plate method with agar and with agar-gelatine-serum has not been found useful.

Potato.—At first it appeared as if the potato was useless for the cultivation of the English bacillus, as it had apparently been found to be for the Danish organism. It is not easy to start cultures on potato from the exudate, but it was found to be a most excellent medium for obtaining sub-cultures. No growth, however, is apparent until the tubes have been incubated from seven to ten days, or even longer. The growth begins as a honey-coloured layer, which soon changes to a deep chocolate colour like that seen in cultures of the glanders bacillus. The bacillus of cattle abortion, then, is chromogenic. After a month the layer of growth is very dense.

Glycerine-broth + Raw Serum.—This is the medium which was used for the purpose of obtaining liquid cultures of the microbe causing the Danish disease. Cultures of the bacillus which was isolated in connection with the English disease were also obtained in this medium, but it was discarded, except for special observations, because of the difficulty of getting large quantities of serum in a

sterile condition for culture purposes, and of the facilities which arise for the contamination of tubes and flasks when raw serum has to be added to them. It was found that if glycerine-broth be mixed in equal proportion with diluted alkalinized serum sterilized at a high temperature, one obtains an equally good and much more convenient liquid medium. Further, if 1 per cent. of grape sugar be added to this medium the abortion bacillus grows much more luxuriantly than in any of the others previously mentioned. Flasks or tubes of this medium may be sterilized in the autoclave, and if sown with abor tion bacilli and incubated under ordinary ærobic conditions a very luxuriant growth develops. The method of replacing the air in the flasks by bubbling filtered commercial oxygen through the liquid for a more or less prolonged period, and then sealing the neck of the culture flasks, does not increase the luxuriance of the cultures. The method, moreover, has many disadvantages. For example, it increases the facilities for contamination, and it renders the flasks liable to burst in the incubator after a period of incubation, because the abortion bacillus in the process of cultivation uses up oxygen, and creates a more or less considerable vacuum inside the flasks. Even if a flask be sown heavily in the ordinary way without replacing the air by oxygen, and the neck be sealed, there is considerable danger of its collapsing inwards owing to the absorption of oxygen by the bacilli from the contained air.

In the liquid serum medium the first growth appears in the form of a grey precipitate. Later on, little yellow and grey flocculi collect at the bottom of the flasks or tubes. The flocculi are more abundant in the raw serum mixtures, especially when sown with exudate.

Milk.—Very good growths of the abortion bacillus were obtained in sterilized milk, but this cannot be considered a useful or convenient medium. Attempts were made, without success, to keep a culture of the abortion bacillus going inside the mammary gland of a milch cow. A pure culture can be injected up the teat of such an animal without causing mammitis, but it was not possible to find abortion bacilli in the milk a week after the injection had been performed.

Physical Requirements.—The abortion bacillus grows best at temperatures between 30° and 37° C. One cannot start a culture outside the incubator, but if actively growing cultures on solid media be incubated for a few days, and then taken out, the growth seems to increase slightly at the temperature of the laboratory.

The bacillus is an ærobe, that is to say, it requires oxygen for its development. It will, however, grow fairly well in a rarefied atmosphere containing very little oxygen, but it will not grow under anaerobic conditions. In fact, one can destroy the vitality of an active culture by putting it in the incubator at 37° C. under anaerobic conditions for two or three days.

Microscopical Appearance of Cultures.—The microscopical appearance of cultures varies greatly, according to the medium from which the preparation has been made, and the seed material from which the culture has been obtained. In preparations made from media containing a large proportion of raw serum (one-third) one finds the microbe growing in clumps, no matter what material has been used for sowing, giving an appearance which might be described as that of staphylo-bacilli. The clumping is particularly evident when the

medium has been sown directly with uterine exudate. Some of the clumps in the latter case may be seen to contain as many as a hundred elements.

These distinct departures from the characters described as typical for the bacillus of the Danish disease again suggested that possibly a different microbe, and one which was not the cause of abortion at all, had been isolated. It was found, however, that if the raw serum medium was inoculated from an agar slope or other clumpless culture the bacillus grew again in the clumped form. Moreover, if raw serum was added to a clumpless liquid culture in sufficient quantity (about one-third of its bulk), the latter after standing was transformed into a typical clumped culture, and it seemed highly probable that the clumped appearance of the cultures in raw serum was simply due to the natural agglutinating power of the serum. This agglutinating power was, of course, destroyed by the sterilizing temperature, with the result that the organism grew in the unclumped form in the heated serum medium. The exudate, however, also contains agglutinating substances, as may be gathered from the clumped appearance of the organisms in the exudate obtained directly from the uterus, and when heated serum is heavily sown with this material it gives rise to agglutination or clumping of the bacilli.

It was also found that whatever form of culture was used for inoculating agar smears the growth on the latter was always the same as that previously described. Finally it was established by experiment on pregnant animals that the agar smear cultures were those of the abortion bacillus.

As previously mentioned, we have been indebted to Professor Bang for kindly sending cultures of the Danish microbe for comparison. From one of those received towards the end of this part of the investigation it was found possible to obtain surface growths on agar and the other apparently atypical growths which had been found to be characteristic of the microbe which was isolated in England. There seems no reason to doubt, then, that the Danish and English diseases are one and the same, and we ave not thought it necessary to coin a name for the bacillus, as t seems appropriate that it should be known as "Bang's Bacillus of Cattle Abortion," in deference to the work of its distinguished discoverer.

Thermal Death-point. — Several observations have been made on the temperature necessary to destroy the vitality of the bacillus of cattle abortion. It was found that in the moist state it was not destroyed at a temperature of 55° C. maintained for an hour, but two hours at the same temperature proved fatal. If it be kept for ten minutes in water at a temperature between 59° to 61° C. and above, its vitality is destroyed, but after exposure in water at 55° for ten minutes it retains its vitality.

Formation of Toxins.—When the bacteria were removed from an actively growing culture by filtering through a Chamberland filter it was found that one could inject large doses of the filtrate into animals without giving rise to any notable disturbance. Apparently there is no appreciable formation of soluble toxins in the cultures.

Virulent Material and its Vehicles.

The contents of the infected uterus, that is to say, the exudate, the fœtal membranes, and the fœtus, are all virulent, since they contain the microbe. As long as the affected uterus remains closed these materials are inoperative so far as other animals are concerned, but once they have been expelled they become dangerous. The discharge which comes from the genital organs for a varying period after the act is also virulent. It is possible that the dung of an animal which has ingested infective material may be virulent for a time, but it seemed very unlikely that this question could be answered by the results of a few experiments. It is improbable that abortion bacilli are excreted in the milk of affected cows, and some experimental observations which were made show that the bacilli cannot be found in the milk a week after a large amount of culture has been injected up the teat.

The length of time during which the virulent materials may remain infective outside the animal is of considerable importance. By reserving this subject for the later stages of the investigation a good many laborious and costly experiments on animals were rendered unnecessary, because it was found that actively growing cultures could be obtained from exudate which had been stored in fluid for six and seven months, and such cultures were used successfully to infect animals for another purpose.

It appears, then, that virulent material may, if kept fluid and free from putrefaction, remain infective for seven months but not for a year. Observations for the purpose of determining more exactly the period between seven months and a year at which it is no longer possible to obtain cultures from exudate stored in fluid are still going on.

We think it is in the highest degree improbable that the microbe propagates outside the animal body; but the advantages from a hygienic point of view derivable from its non-saprophytic characters are largely counterbalanced by the length of time infective material may preserve its virulence outside the animal body. Under natural conditions, exudate takes a long time to dry, for a hard crust forms on the outer layer and protects the inner ones. A small quantity may be quite moist after two months in the laboratory.

Once the contents of the uterus have been expelled the virulent material may be carried to other parts of the cowshed along the surface drains. Infective material may be transported long distances in the soiled manure, on the coats of the aborting animals and their companions, and on the hands and boots of attendants. When carelessly disposed of, it may contaminate the water supply. Dogs may carry a portion of an aborted fœtus or membranes to other parts of the farm or to neighbouring farms. When an animal has aborted at pasture the virulent material may be taken considerable distances by foxes. Pregnant bitches and vixen may become infected by eating virulent material, and by afterwards aborting furnish another means of keeping up and spreading virulent material.

Affected in-calf cows may be introduced into a clean herd, and be the means of establishing fresh centres when they abort; this is one of the most insidious ways in which abortion may be spread, for

it is impossible for the ordinary individual to say whether a pregnant animal is affected or not.

Cows which have aborted must be considered sources of infection so long as the discharge continues to come from the genital organs, and it may continue intermittently for a few weeks if the animals be not treated. Such animals, if not isolated, may continue to infect the sheds, or the pastures when turned out to graze. Moreover, we understand on good authority that it is a prevalent custom to dispose of cows which have aborted rather than risk breeding from them again. It is to be noted also that cows may discharge a day or two before aborting.

Methods of Infection.

Coming to the natural methods of infection, there are two ways in which the virulent material may gain access to the pregnant uterus, viz., by the vagina and by the mouth. By introducing virulent material *per vaginam* five positive and three negative results were obtained. By ingestion three positive results were obtained against one negative. We do not think it would be warrantable on this comparatively small number of experiments alone to conclude that infection is more likely to follow when virulent material is swallowed than when it is introduced by the vagina. With regard to infection by the mouth, however, it is a natural method of infection which until recently did not enter into anybody's calculations regarding the spread of abortion, and knowing as we do that the food, including the pastures, and even the feeding trough, may more or less easily be contaminated on an infected establishment, it seems highly probable that infection by ingestion often takes place. In fact, we are inclined to believe that the disease is more frequently contracted in this way than in any other. Presumably, the bacilli are absorbed from the intestine, and gain the blood stream, whereby they reach the uterus. In the case of a ewe the microbe of cattle abortion was found in the cotyledons six days after infection by the mouth.

Infection by the vagina has always been supposed to be the most frequent natural method, partly because it is thought that the gutter which in most cowsheds runs behind cows standing in line often brings the discharges from an aborting cow in contact with the tails and external genital organs of her companions. In considering the relative importance of infection resulting from the more or less accidental admission of infective material from the floor or dirt of the cowshed, it must be borne in mind that, even when discharges from an infected cow do reach the floor or become mixed with the excreta in the channel behind the cows, the chances must usually be against the bacilli gaining entrance to the genital passages, and that the number of bacilli which could be so admitted to the vulva or vagina under ordinary conditions must generally be small. In the experimental attempts to infect with natural virus by way of the vagina, three were followed by positive results and threee by negative, in spite of the fact that the material was deposited in enormous quantity right on and around the os uteri by means of a long tube.

Infection by the Agency of the Bull.—This must be viewed as a special form of infection *per vaginam*, since it is supposed that the bull, by means of his penis, transfers the bacilli from the vagina of one

cow to that of another. There are *a priori* reasons which compel one to admit that such an occurrence is possible, and there is a certain amount of circumstantial evidence to show that in particular cases in actual practice the disease has been spread in that way.

We have scarcely been able to approach this question from the experimental side, and for the following reasons: It is obvious that in order to test the ability of a bull to transmit the disease each experiment must be planned so that a diseased cow with her genital passages still infected and a healthy cow shall be served in succession, and with only a short interval, by the same bull. But, owing to the moderate number of diseased and healthy animals at our disposal, we never had available for experiment a recently aborted cow and a healthy heifer which were both in œstrum on the same day. In one experiment of this kind an interval of thirteen days elapsed between the service of the cow which had aborted and that of the healthy heifer. The result of the experiment was negative, but little importance can be attached to the fact, (1) because the interval between the two services was too long, and (2) because a single experiment with a negative result carries very little weight.

It has to be observed that, with the discovery that infection can readily be brought about by ingestion of virulent material, most of the circumstantial evidence which seemed to establish the bull as a factor of the first importance admits of another and more probable interpretation. For example, it was held that when heifers which had never been in the infected byres aborted at pasture they must have been infected by the bull, but in such cases we are now in a position to say that if recently aborted cows have grazed on the pastures the heifers may have been infected by swallowing grass or water contaminated by the discharge from the genitals of the former, or that virulent material may have been conveyed on artificial foodstuffs from the buildings. Without denying that the disease may sometimes be spread by coition, we think that nothing more than a quite subsidiary *rôle* in the spread of epizootic abortion can now be assigned to the bull.

Symptoms.

It may be taken that under natural conditions infection is insidious, and that no noticeable symptoms arise until the animal is about to abort. Even when enormous quantities of exudate or culture are injected into the vagina no local symptoms, such as catarrh or inflammation, follow.

The course of the disease is as a rule slow. In ten experimentally infected animals which aborted, or which were killed when showing unmistakable symptoms of abortion, the average period between infection and the act was 126 days. The shortest period in any of these animals was thirty-three days, and the longest 230 days. The average period of pregnancy at which abortion took place was 195 days, the earliest 149 days, and the latest 254 days; but it should be pointed out that one can hardly draw any inference applicable to practice from the observations regarding the period of pregnancy, because most of the experimental animals were infected at different stages. There is also good reason to believe that in an animal infected at a late date, and less frequently in one infected in the earlier stages of pregnancy, a premature birth may occur at a period so near the full

time that it might not occur to the mind of an ordinary owner that the birth was not normal.

In four of the above-mentioned ten animals no premonitory symptoms of abortion were observed, but as the act took place in two of the four cases during the night, it is possible that there may have been premonitory symptoms for a few hours. In six out of the ten cases distinct premonitory signs were noticed for periods extending from a few hours to three days in one case and two days in another. One of the first symptoms observed is that the animal "makes a bag," that is to say, the udder swells rather suddenly. In fact, in heifers about to abort in the later stages of pregnancy one may find that the gland has become functional a month or more before its time. The animal becomes uneasy, stamps its feet, and, if in a loose box, moves restlessly about. The vulva is slightly swollen, and the ligaments are somewhat relaxed. At intervals, quantities of mucus, which may be blood-tinged, and later a yellow discharge, come from the vulva. These discharges soil the tail of the animal, and they may even be found on the floor of the stall behind her. In the case of animals aborting in the earlier stages the fœtus may come away completely enclosed in the membranes. In the later stages, however, the membranes may be retained in whole or part, and the retained portions are very difficult to remove with the hand. Their presence gives rise to the well-known complications following upon retained placenta. After the act of abortion a thin yellowish discharge continues to come from the genital organs for several weeks, and this condition is maintained for even a longer period when the placenta has been retained. It would appear that in cases where the fœtus and its membranes are completely expelled contraction of the uterus may take place in a few hours.

It is to be noted that one must not always accept slight swelling of the udder, accompanied by restlessness and even a small rise of temperature, about the fifth or sixth month of pregnancy, as evidence that the animal is going to abort, because such symptoms may be observed in perfectly healthy animals.

Distribution and Identity of the Disease.

In the absence of an order requiring the disease to be reported, it is not possible to obtain an exact idea of the extent to which epizootic abortion in cattle prevails throughout Great Britain. We are in a position to state, however, that it is is very prevalent. By the co-operation of the Honorary Correspondents of the Board of Agriculture and Fisheries, and many stockowners throughout Great Britain, we have been put in touch with a great deal of valuable material, which has enabled us to establish by examination the existence of epizootic abortion of cattle on fifty-five farms in thirty-six counties. We have not in the course of our investigations met with any epizootic abortion in cows which was not due to the bacillus of abortion. We do not deny that odd cases of abortion may arise from accident or poisoning by such substances as lead, but we have no hesitation in stating that we believe that at least 99 per cent. of the outbreaks of cattle abortion which assume epizootic characters are due to infection by the bacillus of cattle abortion, and that the fact of a cow having aborted on premises formerly believed to be clean is a sufficient reason

for suspecting that the disease has been introduced. We desire to add to this statement that, if the case be enquired into without delay after an animal has aborted, there will be very little difficulty in arriving at an accurate diagnosis.

Species of Animals which are Susceptible.

At the commencement of this investigation it seemed not improbable that epizootic abortion of the different domesticated animals might be one and the same disease. This view appeared to have support when it was found in the laboratory that with the infective material of cattle abortion—uterine exudate and artificial cultures obtained therefrom—pregnant females of most of the other domesticated species could be experimentally infected. Abortion was experimentally induced by introducing the microbe of cattle abortion into the bodies of cows, ewes, goats, bitches, and guinea-pigs. A single experiment on a pregnant sow gave a negative result. This experiment has been repeated, but we have not thought it necessary to delay this part of our report for the further result, and we think it highly improbable that the sow is naturally immune, in view of the susceptibility of other species. As regards the mare, we have done no experiments at the laboratory, but a small number of observations have been made in the field and laboratory which go to show that the equine disease is not caused by the bacillus of cattle abortion. It may be mentioned, however, that Bang has successfully infected mares with the latter microbe. Notwithstanding the probability, it would have been rash to conclude definitely that, because the various species of domesticated animals can be infected with the bovine bacillus in the laboratory, that organism is responsible for outbreaks of abortion among such species in the field. We have not accepted even the bovine bacillus as the cause of epizootic abortion in cattle on the evidence of laboratory experiments alone, but have added to it direct evidence from the field.

As already mentioned, the field observations make it probable that the bovine bacillus is not responsible for abortion in mares. With regard to sheep, we have never succeeded in finding the bacillus of cattle abortion in the membranes of ewes aborting in the field, although much material has been examined; nor have we ever found it in the uteri of ewes from aborting flocks, even when the animals were killed while showing premonitory symptoms. Further, a totally different microbe—a vibrio—has repeatedly been isolated from outbreaks of abortion in ewes, and has been successfully employed at the laboratory to experimentally infect other ewes which had been tupped at the laboratory and were pregnant for the first time. Pregnant cows, however, cannot be infected with this vibrionic abortion of ewes, and the sheep disease will be the subject of a later report.

We are of opinion that bovine abortion, which is the subject of this first report, is essentially a disease of cattle, and although other species can be experimentally infected in the laboratory they are not likely to contract the disease in practice except as the result of gross carelessness in the disposal of infected material. Although it is hardly germane to the present inquiry, we think it advisable to point out that, since the bacillus of cattle abortion is pathogenic for so many species, the possibility of the human female being infected should not be lost sight of.

Diagnosis.

It is an easy matter to identify the characteristic clumps of abortion bacilli in microscopical preparations made from the uterine exudate discharged immediately before and after abortion. The exudate can be collected from an aborting animal on swabs of cotton-wool for transmission to the laboratory, or smears can be made on glass slides for examination later. The most reliable material to send away for diagnosis in the laboratory is the fresh fœtal membranes, but the contents of the fœtal stomach may also contain the microbes. The placental cotyledons from a cow affected with epizootic abortion often have a yellow bleached appearance, and the characteristic clumps of bacilli can almost invariably be found and identified with the microscope in material scraped from their surface, even when putrefaction has begun and the material swarms with other microbes.

The problem of diagnosis, however, was not completely solved by establishing a reliable method of recognizing epizootic abortion after the act. As already explained, the disease runs a chronic course without symptoms, and although animals are infected a considerable time before aborting they only become infective for other animals during and after the act. The importance, then, of obtaining a method whereby the disease may be diagnosed before the act is obvious. To this end the agglutinating power of the serum of affected animals as compared with that of healthy ones on cultures of the bacillus was studied, but, although it is not without value in epizootic abortion, the agglutination test cannot be regarded as free from great risk of error.

Abortin.—A material analogous to tuberculin was prepared from cultures of the bacillus of cattle abortion. When this substance is injected into the veins or under the skin of an infected animal a temperature reaction generally follows, commencing at the fourth hour after injection and lasting usually until the fourteenth hour. Intravenous injection, however, may also be followed by very alarming systemic symptoms of the nature of anaphylaxia, and characterized by rapid breathing, dyspnœa, the flowing of saliva from the mouth, rigors, and straining. The intravenous method is not without danger, and would probably be objected to in practice on account of the alarming reaction it may give rise to. The subcutaneous method has not been followed by similarly alarming symptoms, but a larger dose—½ to 1 c.c.—of the crude abortin has to be injected.

The injection of abortin to normal animals may be followed by a temperature reaction, but in the observations so far made on animals whose complete history was known—those of the laboratory—the temperature of normal ones did not rise in any case above 103·6° F., whereas in the affected it rose to 104° F. to 105° F., and 106° F., and even higher. The abortin test is now being tried on infected herds in the field, and the results will be reported when they have matured. This will, of course, require some time, as the period of pregnancy in the cow extends over nine months, and it will not be possible to judge of each test until the animal has either aborted or calved normally.

Complement Test.—The observations which are recorded in the Appendix hold out a strong hope that the method of diagnosis based upon what is termed "fixation of the complement" may prove to be

reliable for the diagnosis of epizootic abortion even in its early stages. The actual technique of this method is a little complicated, but the test depends for its success on the fact that the abortion bacilli, although themselves confined to the uterus, manufacture a substance which passes by absorption into the circulating blood, in the serum of which it can be detected by a highly specific character, namely, its affinity for abortion bacilli.

The majority of the observations which have been made have been concerned with the trustworthiness of this method of diagnosis after the act of abortion, and the results indicate that at least for some weeks after the act the method is very reliable. Should this estimate be borne out by further and more extended observations in the conditions of actual practice, the method will prove of great value in those cases in which, owing to the interval which has elapsed since abortion, a direct bacteriological diagnosis can no longer be made.

But, of course, when the blood serum of a cow that has aborted reacts to the test, that is not because of the act of abortion, but because of the state of infection which preceded and determined the abortion; and hence it follows that, although the majority of the observations recorded in the Appendix were made on cows which had actually aborted, the results afford evidence that this method of diagnosis may prove trustworthy for the detection of the disease in apparently healthy pregnant cows in an infected herd.

Natural and Acquired Immunity.

No evidence has been obtained during the investigation to show that natural immunity to the abortion bacillus is possessed by any individuals of the bovine species.

From general inquiry we are inclined to believe that a majority of cows at least acquire a serviceable degree of immunity as the result of an attack, but there is no doubt that in practice a considerable proportion abort twice, and a small number abort even three times.

Cows which have aborted very often return to the bull two or three times, unless a long interval has elapsed since abortion took place. It is believed by many farmers that each failure to hold to the bull really means that the cow has aborted a very young fœtus. This opinion, however, is based merely on surmise, and no evidence in support of it has been obtained by carefully watching the animals which aborted at the laboratory and were afterwards put to the bull.

Immunization.

The most hopeful line of inquiry seemed to be the production of immunity by inoculation of large doses of pure culture. One of the great objections to the protective inoculation methods in practice is the number of operations necessary to ensure protection. But, owing to the harmlessness of large quantities of pure cultures of the abortion bacillus when injected into non-pregnant animals, it seemed possible that whatever degree of immunity could be established by a practicable number of small doses might be conveyed by inoculating one large dose.

It was necessary, of course, that the immunizing dose should be inoculated some time before the animals were put to the male, in order

to give their bodies time to rid themselves of the abortion bacilli before pregnancy began, as otherwise the effect would have been to infect the pregnant uterus. The period aimed at for putting the animals to the male after inoculation was from six weeks to two months; but, of course, it could not be timed exactly.

It was quite beyond the scope of an inquiry such as this to attempt to experiment on, say, 100 animals at the laboratory, nor would it have been possible to simulate the less severe conditions of infection obtaining in the field without converting the experimental station into an infected farm. Seeing, however, that the immunization process is harmless to non-pregnant animals, it should not be difficult to induce plenty of owners of infected herds to try protective inoculation under the supervision of the Board, and in this way obtain an idea of its value as a practical measure in fighting epizootic abortion. The most useful way of employing preventive inoculation would be to inoculate all non-pregnant heifers and cows on an infected establishment six weeks or two months before putting them to the bull, and the method might also be used in the same way to further develop the resistance of animals which have aborted, and which are still non-pregnant.

Field operations are already in progress on the treatment of infected herds. There are decided indications that there will be no lack of volunteers anxious to put their infected herds at the disposal of the Committee, and a large amount of material is being prepared for observations in the field. These field observations, however, cannot be expected to mature for a year or more, when it is possible they may provide material for a special report.

Curative Measures.

On account of a somewhat prevalent idea that carbolic acid given internally will cure animals affected with abortion, or prevent the infection of healthy pregnant animals, it was considered advisable to put this alleged remedy to an experimental test. A heifer, 188, was infected with virulent material forty-three days after becoming pregnant, and thirty days after infection she received every other day 2 drachms of carbolic acid in a mash by the mouth, alternated every fortnight by subcutaneous injections of 1 drachm in glycerine and water given every other day. This treatment was continued for ten weeks. She aborted one hundred and two days after infection and in the tenth week of treatment; abortion bacilli were found in the discharges.

From the first it seemed most unlikely that carbolic acid or any other disinfectant administered even in a poisonous dose would be absorbed and reach the uterus in a sufficiently concentrated form to have any action on its bacterial contents. There are many farmers who have had no success whatever in the field with the carbolic acid treatment for abortion, and the evidence on which the alleged successes are based will hardly stand analysis. In the first place, the animals put under the treatment in practice are not known to be infected, and yet every one which does not abort is regarded as cured by the advocates of the method. In the second place, the treatment is usually adopted towards the end of an outbreak, that is to say, at a time when abortion is practically confined to a proportion of the

animals recently brought into the herd; and the reduction in the number of cases is attributed to the alleged remedy, whereas it is more open to a totally different explanation, viz., that after the third year the disease practically confines itself to some of the new animals brought in, with the result that since these form only a small proportion of the whole the opportunities for infection are greatly diminished.

The usual history of an outbreak of abortion is that for the first two or even three years it claims many victims in the original herd, and after this one gets only a few odd cases a year, unless many new animals have been introduced.

Experiments were also undertaken to see whether actually infected animals could be successfully treated by subcutaneous injections of bacilli killed at 55° C.

Treatment with dead bacilli failed in one case, but succeeded in two other cases. One cannot hope to settle the value of this treatment in the laboratory, but, since it is harmless, there should be no difficulty in getting owners of infected herds to try it. Infected herds have already been put at our disposal, and the suspected animals will be treated with large doses of dead bacilli. It is hoped the results, along with those of immunization, will provide enough material for a future report.

The plan of the field observations on treatment is to try to pick out the infected animals by one of the methods mentioned under "Diagnosis," isolate them, and treat them with large doses of dead cultures.

Prevention and Eradication.

Spraying of the External Genital Organs.—We think, that this method is useless so long as the animals remain in an infected byre, and that it may be discarded. Immediately before removing an animal from infected to clean premises, however, we think it would be advisable to thoroughly wash the posterior portions of its body with a disinfectant solution, such as corrosive sublimate, 1 in 2,000, or carbolic acid, 3 per cent.

Isolation of Animals as soon as they show Signs of Abortion.—The necessity for this measure is obvious, and its importance cannot be too much insisted on. In the section on "the virulent materials" it was explained that an infected animal only becomes infective to others immediately before the act of abortion, and may remain so for some weeks afterwards. Under the heading of "Symptoms," however, it was stated that only a proportion of the affected animals showed premonitory symptoms, and that quite a number may abort amongst their companions without warning. Under such conditions, then, measures of immediate isolation lose much of their undoubted theoretical value, owing to the difficulty in the way of carrying them out in practice.

Isolation of the affected animals, however, must be complete before and after the act to be of any real value. Having regard to what appears to be the most common form of infection, viz., by ingestion, we do not think that anything material is to be gained by merely putting all the cows about to abort and those which have aborted at the lower end of a byre, so that the infective discharges may not come in contact with the external genital organs of their fellows.

Internal Administration of Carbolic Acid.—The uselessness of carbolic acid and other antiseptics as curative agents has already been referred to. As a preventive agent by internal administration we believe carbolic acid to be equally useless.

It seems probable that, as a rule, the genital organs cleanse themselves by natural means a comparatively short time after abortion has taken place. Almost immediately after abortion and expulsion of the membranes the uterus contracts, and its internal surfaces come into apposition. Its condition is such that it would not be possible to force fluid into it with a pump from the vagina. Apart then, from the probability that disinfection of the uterus by antiseptics is not necessary to rid the organ of abortion bacilli, we are of opinion that it is futile to attempt it by irrigation methods. So long as a discharge continues to come from the genital passages, we think that for hygienic and therapeutic reasons they ought to be cleansed once or twice daily by the intra-vaginal injection of tepid antiseptic solutions, such as a 2 per cent. solution of carbolic acid or a 1 in 3,000 solution of corrosive sublimate, but not on the ground that the injections will disinfect the uterus. We are of opinion that it will seldom be necessary to continue the injections for more than a month, and that after three months there should be small risk in putting the cow to the bull, provided she is afterwards protected against fresh infection.

Removal and Disposal of Animals which have Aborted.—It is quite a prevalent custom to feed for the butcher cows which have aborted. It is also customary to sell such cows alive in the open market. The second custom we consider likely to introduce disease to other establishments, unless the animals have ceased to discharge; they should, we think, be kept for at least three months after abortion before being sent for sale.

The first custom is less objectionable than the second, but we think that a breeder will be more likely to get rid of abortion from his herds by keeping such animals than by disposing of them and bringing in new ones before his entire herd is free from the disease. There can be no doubt that in most cases an attack of the disease greatly increases an animal's resistance to future attacks, and that in a large proportion of the affected, probably in the majority, this resistance is sufficient to fortify them against infection during their next pregnancy. It is beyond doubt that a considerable proportion may abort twice in succession, but it is not improbable that inoculation methods may now be successfully employed to exalt their resistance. In the midst of infection there is no better guarantee against the disease than the possession of an immune stock, and for this reason we consider that on infected premises the animals which have already aborted are to be looked upon as valuable assets for purposes of eradication, much more valuable than the new and susceptible animals brought in. We find, however, that a small proportion of cows will not hold to the bull for an indefinite period after abortion, and it may be found better to fatten off such animals, unless they are of high value.

The Keeping of a Special Bull for Cows which have Aborted.—We have already stated that we do not consider the bull a factor of the first importance in the dissemination of abortion, but that infection by means of a contaminated bull must be looked upon as a distinct

possibility. We think, therefore, that there is something to be said in favour of keeping a bull for the service of cows which have aborted, and, when that is not possible, of disinfecting the external genital organs of the bull after he has served such cows. Of course, if the cows can be immunized the same bull might be used for all. We do not think that cows from a clean establishment should be sent even to a clean bull on infected premises, and it is also inadvisable that cows from infected premises should be sent to a bull on a clean establishment.

Destruction of Virulent Material and Disinfection of everything Contaminated by it.—The immediate disinfection of the virulent materials and contaminated objects is of great importance, more especially as it appears that the natural virus may remain active for a long time outside the body. The soiled litter, dung, exudate, membranes, and fœtus should all be removed at once, preferably after they have been treated with caustic lime. After removal they should be soaked in paraffin and burned, or buried in a deep pit, preferably the former. On no account should the fœtus and membranes be fed to pigs or dogs. When a fœtus is aborted alive, as sometimes happens, it seldom survives long, and it is advisable to kill and destroy it, since it may excrete abundance of virulent material from its intestines if allowed to live. If, however, it be decided not to kill it, it should immediately be isolated. The walls of the stall and the floor should be washed or strewn thickly with caustic lime, or drenched freely with boiling water. The temperature necessary to kill the bacillus is not great, and this simple method of disinfection should prove efficacious. Lastly, the boots, clothing, and hands of attendants should be disinfected by making use of any reliable disinfectant, such as a 3 or 4 per cent. solution of carbolic acid.

The Keeping of a Goat amongst the Cows.—This, we believe, can only have had its origin in ignorant superstition. But we feel bound to mention it, as the question of its efficacy has quite frequently been seriously put to us. We would point out that goats themselves can be infected with cattle abortion, and that both male and female goats were on our premises during the greater part of the time occupied with the cattle experiments, and their presence did not prevent animals from aborting.

Preventive Inoculation.—At this stage of the inquiry we think we are justified in provisionally adding preventive inoculation to the prophylactic measures previously discussed.

We have already cited experimental evidence to show that the bovine female can be rendered highly resistant to infection with virulent material by the subcutaneous injection of a comparatively large quantity of active liquid culture of the abortion bacillus. Should the results under the conditions of actual practice bear out those already obtained in the laboratory, stockowners will be in possession of a preventive method, which is, perhaps, the most valuable of all methods for dealing with a disease of the nature of epizootic abortion. Of course, one would only employ such a method in herds in which infection already exists, and the best way to make use of it will be, assuming that the results in practice bear out those obtained at the laboratory, to inoculate all new animals coming in, and those already in the herd which have calved normally, about two

months before they are put to the bull. Since one cannot be certain that every animal which has aborted will have acquired immunity, it will be advisable also to inoculate the latter to exalt whatever degree of resistance they have acquired from the natural attack, but, as already mentioned, the animals which have aborted should not be put to the bull for a period of three months.

For reasons already explained it is not possible to immunize pregnant animals with living cultures. It is possible, however, that a not inconsiderable degree of immunity of shorter duration may, with safety, be bestowed on pregnant animals by inoculating them with a large dose of bacilli which have been killed at a low temperature. This, however, will be dealt with in a later Report.

TEST OF ROBERTS'S SO-CALLED ANTI-ABORTION SERUM.[1]

THE Act of Congress making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1909, provides as follows: "That the Secretary of Agriculture is authorized to purchase in the open market samples of all tuberculin, serums, antitoxins, or analogous products, of foreign or domestic manufacture, which are sold in the United States for the detection, prevention, treatment, or cure of diseases of domestic animals, to test the same and to publish the results of said tests in such manner as he may deem best. . . ."

For some time past there have appeared in certain agricultural and live-stock journals advertisements of "the Roberts serum treatment" for abortion in cows, by the Dr. David Roberts Veterinary Company, Waukesha, Wisconsin. In the advertising matter sent out by that Company there is an order sheet giving a list of "remedies," one of which is "Anti-Abortion Serum, for preventing and curing abortion in cows."

In accordance with the provision of law above quoted, the Department recently examined a sample of the preparation referred to. Analysis by the Bureau of Animal Industry shows that the preparation is not a serum and contains no serum. The sample contained approximately 98 per cent. of water, the remainder consisting of phenols (carbolic acid), oil of cloves, and a very small proportion of what appeared to be some form of vegetable matter.

FOOT-AND-MOUTH DISEASE.[2]

BY STEWART STOCKMAN, M.R.C.V.S., CHIEF VETERINARY OFFICER TO THE BOARD OF AGRICULTURE.

FOOT-AND-MOUTH disease appeared amongst the cows of a city byre in Edinburgh on February 2, 1908. On that day at least one cow was noticed to be ailing, but it was not until February 4 that foot-and-mouth disease was suspected, when between thirty and forty cows out of a total of 111 bovines (110 cows and a calf) showed typical symptoms

[1] United States Department of Agriculture. Circular No. 29.
[2] From his Annual Report for 1908.

of the disease, and the premises were placed under restrictions. By February 5 eighty-one animals on the place were affected.

On February 5 the Board issued an order declaring the premises affected with foot-and-mouth disease. I travelled up to Edinburgh on the night of February 5, arriving at the scene of the outbreak at Elvan Bank, Gorgie, on the morning of the 6th. The infected byres, two in number, stood back from a thoroughfare, and were entered by a side cart track. About 20 yards distant, with entrance facing that of the infected place, were the premises of another owner on which were eighty-one cows. The information available pointed strongly to infection having been introduced by a small consignment of hay from Holland, which had been divided up between the owner of the Elvan Bank premises and another owner in a distant part of the city. The cows of the latter, however, were healthy, although a longer time than the average incubation period had elapsed since the suspected hay had been used, and it seemed unlikely that another outbreak was to be expected in this quarter; but, to avoid all possible risks, the premises had been put under restrictions. No animals had been introduced on the infected premises within the ordinary period of incubation, but three cows had been brought in thirteen days before the outbreak. The three cows had come from premises upon which foot-and-mouth disease did not exist, and they were amongst the last to develop the disease. No animal had left the byres later than eight days before the first cow was noticed to be ailing. Manure had been removed from the infected premises at a time when it might possibly have been contaminated, but it had been located by the Board's inspectors, and provision had been made for destroying any possible risk of it spreading infection. It seemed beyond doubt that the outbreak was the initial one, and it also seemed highly probable that, owing to the vigilance of the local authorities and the Board's inspectors, all possible ramifications of the outbreak had been surrounded. I, therefore, felt justified in telegraphing to the Board that the outbreak would be best dealt with by slaughtering the cows on the infected premises, and those on immediately adjoining premises which were still free from disease. The total number of animals on the two premises amounted to 192. The animals on the infected premises were all slaughtered by the evening of February 9. Of the 111 animals on the infected premises, two cows and one calf escaped infection up to the time of slaughter.

The slaughter of those on the adjoining premises was completed on February 12. The veterinary inspectors of the Board who had not been in contact with the infected premises made a house to house visit of byres in Edinburgh and district. Ninety-four premises were visited, 2,649 cattle were examined, and all were found to be free from disease.

A second outbreak occurred on premises about three-quarters of a mile from the first on February 23, that is to say, fourteen days after the slaughtering out of the animals on the first infected premises was completed. The owner in the first outbreak had hired the second premises on February 4, and had stocked them with twenty-one cows from outside sources for the carrying on of his business. The twenty-one cows were bought on February 4 and 5 from sources beyond suspicion. The only communication which could be traced, at least, between the first and second premises, was that the owner himself had gone to the

latter on February 17, that is to say, eight days after the animals on the former had been slaughtered, and six days before the disease appeared on the second premises. The working clothes he wore at the first premises had been destroyed, and he had disinfected himself. It is possible, though improbable, that the owner remained contaminated by the virus of the disease for eight days—from the 9th to the 17th—but the period between the 17th and 23rd—six days—is quite within the limits of the incubation period of foot-and-mouth disease. There can be no doubt that the second outbreak arose from the first, but the information which could be obtained regarding the intercommunication between the two establishments does not account for it very satisfactorily. Inquiry was made with the view of discovering whether any of the attendants had contracted foot-and-mouth disease, as this might have accounted for the second outbreak, but nothing of the kind could be traced. No animals had been moved off the second infected premises, and the last removal of manure had taken place on February 15. This manure was traced by the Board's inspectors, and was dealt with.

In close proximity to the second premises were eight other establishments containing 109 cows. It was discovered on February 27 by Mr. Berry, one of the Board's veterinary inspectors, that the drainage from the manure heap of the second premises was percolating through the wall into the feeding trough of a cow on another establishment immediately adjoining. This animal was found to have a high temperature and to be showing rather suspicious symptoms, and on the morning of the 28th, definite lesions of foot-and-mouth disease were apparent. On the third establishment here were sixteen cows; no animals or manure had recently been moved off. The twenty-one cows concerned in the second outbreak were all slaughtered on February 25, three only being affected at the time. The sixteen cows on the third premises were slaughtered on February 28, one only being then affected. It was also decided as a measure of further precaution to slaughter the cows, fifteen in number, on two other immediately adjoining premises, although they were at the time apparently healthy, and this was completed on February 29.

In all three outbreaks there were 148 bovine animals on actually infected premises, 112 of which became affected before slaughter. On adjoining premises not actually infected, but in serious danger of becoming so, there were ninety-six bovines, all of which were slaughtered as a precaution against the further spread of the disease. The infected and adjoining premises were kept under quarantine for a month after disinfection was completed, and no further outbreak occurred.

The facts in connection with the origin of this outbreak present features of the highest importance in State hygiene. There was little doubt at the time, and subsequent events have removed all doubt, that the outbreak reported on February 4 was the initial one. Moreover, it occurred in Scotland, which had been free from foot-and-mouth disease (a disease which cannot be concealed) for fifteen years. One was able with certainty to eliminate such possible carriers as affected animals, human beings from infected countries, and sea birds. Foreign straw had been used, but had been discontinued a month before the outbreak. The only material upon which suspicion rested was a small consignment of hay imported from Holland, a country which was

infected with foot-and-mouth disease. The said hay was brought into contact with the animals of the first outbreak on January 29. Four days afterwards one animal was observed to be ailing, and on the sixth day after the hay was introduced thirty to forty showed unmistakable symptoms of foot-and-mouth disease, that is to say, within the recognized incubative period of the disease. Admitting, and I think it must be admitted, that infection was imported in the said hay, the above circumstances must alter the generally accepted ideas regarding the time that the virus of foot-and-mouth disease may retain its virulence in practice. It has been generally observed that new animals may be put in association with others which have recovered from the disease after two or three weeks, and that it is only exceptionally that the former contract foot-and-mouth disease. Experimentally it has been found that the virus becomes inactive if dried in sunlight during twenty-four hours. It has also been observed, however, that if pure lymph be kept in the ice chest and away from the sunlight, that is to say, under experimental conditions, it may retain its virulence for three or four months.

It would appear from our experience in the Edinburgh outbreak that the conditions necessary for the long upkeep of virulence may be found inside a bale of hay during the cool season of the year. The hay in question had been imported from an infected country fully two and a half months before it was brought in contact with the animals which developed the disease, and assuming that it was contaminated on the farm of origin, of which however we have no evidence, the virus might in such case be held to have remained active for at least three and a half months. It had certainly retained its virulence for two and a half months, since it had during that period been beyond all sources of possible contamination.

FOOT-AND-MOUTH DISEASE CAUSED BY VACCINE.

FOOT-AND-MOUTH disease in cattle coming from the stockyards of East Buffalo, U.S.A., was distributed to nine separate farms. It was reported to the Chiefs of the Bureau of Animal Industry, and the diagnosis was confirmed by them.

It was difficult to trace the point of origin beyond the Buffalo stockyards; but while the matter was under investigation a telegram was received from Detroit, Michigan, that a mild form of foot-and-mouth disease was prevailing on several farms in that vicinity. Among the animals infected in that district were twenty-one heifers which had been used for the production of vaccine virus. This caused contamination of the vaccine material to be suspected. As the United States Public Health and Marine Hospital Service, under the Act of Congress of July 1, 1902, is charged with the supervision of biological products used in the prevention and treatment of diseases of man, the co-operation of that Service was requested in an investigation of the disease.

The character of the lesions in the mouths and feet of the twenty-one heifers showed that they were in the fourth stage of the disease,

viz., the one of healing, and that these lesions were older and more nearly healed than those found in any other centre where infection had been observed.

It was deemed advisable to make a thorough investigation of the movements of the twenty-one vaccinated cattle, and to ascertain, if possible, what connection, if any, the use of these cattle had with the origin of the outbreak of the disease. The writers of this report therefore proceeded to the laboratories of the manufacturer and commenced the enquiry.

The cattle furnished for vaccination purposes were supplied to manufacturer A by the firm of Shaw Brothers, and after vaccination and removal of the vaccine pulp, were returned. The animals were vaccinated on September 23 and October 6, and turned back to Shaw's on October 16, and driven to the Detroit stockyards, and then taken to a town 15 miles distant and dispersed. They were detained in the pens at Detroit two hours, and watered and fed. These pens subsequently infected a second batch of cattle, and seven bulls in this batch carried the infection to other centres. Cattle occupying the pens for six days previous to the vaccinated cattle were traced to their destinations with negative results, whilst negative results also followed on the investigation of places whence the twenty-one cattle came before being taken to the vaccine stables of manufacturer A.

Three separate strains of vaccine virus which had been used by the firm in 1908 were secured. Six calves and one cow were inoculated in different ways by scarification of lips and abdominal skin, and intravenous injection, and all exhibited the typical lesions of foot and mouth. One cow and calf were infected by natural methods from the vaccine virus by exposure and in contact infection.

Manufacturer A had received the only strain of vaccine that proved to be contaminated from manufacturer B, so B's establishment was visited. Experiments were conducted with his vaccine, and the disease transmitted to sheep by intravenous injection. Four calves were also vaccinated with the virus by an independent investigator, and they all took foot-and-mouth disease.

The ample clinical notes taken showed that the vaccine virus propagated by manufacturer B in April and May, 1908, was contaminated with the virus of foot-and-mouth disease. The history of the strain showed that it was of Japanese origin.

Lœffler and Frœsch showed in their researches upon foot-and-mouth disease that the surest mode of infection is by introduction of the contents of a vesicle into the circulation. They also showed that cow-pox does not protect against foot-and-mouth disease, nor foot-and-mouth disease against cow-pox. Starcovici produced a mixture containing cow-pox virus, and thereby claimed to have given a benign form of foot-and-mouth disease, as a result of which inoculated animals may be used without interruption in agricultural work.

No instance of the transmission of foot-and-mouth disease to man through vaccine virus has been recorded. Hereafter manufacturers will be required to test their virus for the presence of foot-and-mouth infection, as they are now required to test it for the presence of tetanus and other pathogenic micro-organisms. Regulations to prevent the importation or sale in interstate traffic of vaccine contaminated with foot-and-mouth disease have been issued.

CONCLUSIONS.

(1) The recent outbreak of foot-and-mouth disease in this country started from some calves used to propagate vaccine virus.

(2) The vaccine virus used on these calves has been proved to contain the infection of foot-and-mouth disease.

(3) The outbreaks of foot-and-mouth disease in 1902-03 probably had a similar origin.

(4) It is probable that the foot-and-mouth infection got into the vaccine virus in some foreign country where the disease prevailed, and was introduced into the United States through the importation of this contaminated vaccine.

(5) The symbiosis between the infections of vaccinia and foot-and-mouth disease is especially interesting. Animals vaccinated with the mixed virus, as a rule, show only the lesions of one of these diseases, viz., vaccinia; nevertheless, the infectious principle of foot-and-mouth disease remains in the vaccinal eruption.

[From a report on "Origin of the Recent Outbreak of Foot-and-mouth Disease in the United States," by John Mohler, V.M.D., and Milton Rosenau, M.D., of the Bureau of Animal Industry.]

Review.

THE "PROGRESSIVE" CASE-TAKING NOTE-BOOK. Suggested by R. Glave Saunders, M.R.C.V.S. Published by C. H. Huish and Co., 12, Red Lion Square, London.

In sending us this little note-book, which measures 6½ in. long and 3½ in. wide, Mr. Saunders sums up its advantages as follows:—

"(1) It is of pocket size.

"(2) It is cheap, and can consequently be used for all cases. (9d. each, postage 2d., 100 pages).

"(3) Complete notes of a case can be made with a minimum amount of writing, and therefore with no loss of time. The various headings (cause, pulse, diagnosis, treatment, &c.) are printed on the inside of each cover, while the notes are made opposite on a perforated sheet.

"(4) As soon as filled up (or when convenient), each page of notes can be detached and filed or otherwise preserved for future reference; or, by using a series of files, cases could be classified in any way suggesting itself to the clinician.

"It is, perhaps, late in the day to emphasize the importance and interest of taking notes of every case, and I have always considered the reason this is so rarely done is that note-books are cumbersome, elaborate, and expensive, and the recording of a case is consequently a tedious process.

"How many cases we can remember which were seemingly unimportant at first, but which terminated fatally, and yielded interesting *post-mortem* lesions, and how exasperated we have felt that no notes have been kept."

We entirely agree with Mr. Saunders as to the utility of this little note-book. We welcome it, and hope that many of our readers will use it and record in the VETERINARY JOURNAL the interesting cases which they will thus be able to do so easily. We are afraid of one little point, however, and it is that most practitioners may regard elevenpence too much to pay for it.

UNIVERSITY OF LONDON.

FACULTY OF SCIENCE (VETERINARY SCIENCE). PRELIMINARY EXAMINATION FOR INTERNAL STUDENTS.

PASS LIST, JULY, 1909.

2452. Minett, Francis Colin, Royal Veterinary College.
2453. Morton, William Ford, Royal Veterinary College.

Examiners: Inorganic Chemistry: A. W. Crossley, W. P. Wynne, A. McKenzie, John Wilson. Physics: J. A. McClelland, H. A. Wilson, W. H. White, R. S. Willows.

FACULTY OF SCIENCE (VETERINARY SCIENCE). GENERAL INTERMEDIATE EXAMINATION (PART I.) FOR INTERNAL STUDENTS.

PASS LIST, JULY, 1909.

2461. Edwards, James Thomas, Royal Veterinary College.

Examiners: Organic Chemistry: A. W. Crossley, W. P. Wynne, A. McKenzie, John Wilson. Veterinary Anatomy: O. C. Bradley, E. S. Shave. Biology: J. G. Kerr, W. H. Lang, F. W. Oliver, W. G. Ridewood, F. Buchanan, F. E. Fritsch, D. T. Gwynne-Vaughan, H. W. Unthank.

FRANK W. WRAGG MEMORIAL FUND.

STATEMENT OF RECEIPTS AND EXPENDITURE.

	£ s. d.		£ s. d.
To Subscriptions	132 19 6	By Artist's Fee for Oil Painting, Frame, and Inscription ...	50 0 0
		,, Chairman's Expenditure for Stamps, Stationery, &c....	1 0 6
		,, Secretary's Expenditure for Stamps, Stationery, Circulars, &c.	1 19 0
		,, Cheque Book	0 1 0
		,, Argus Press for Printing and Envelopes	0 19 0
		,, Auditor's Fee	0 10 6
			54 10 0
		,, Balance, handed to Mrs. Wragg, as per resolution	78 9 6
	£132 19 6		£132 19 6

I hereby certify that the documents and receipts in connection with the above have been produced to me, which I have found to be correct.

GEORGE WRIGHT (*Accountant*),
8, Thurlow Terrace,
Haverstock Hill, London, N.W.

July 27, 1909.

JAMES F. SIMPSON, *Chairman.*
SIDNEY VILLAR, *Secretary.*

Translations and Extracts.

ON THE CONTAGION OF TUBERCULOSIS BY THE RESPIRATORY TRACT.

BY PROFESSOR CADEAC, OF LYONS.

THE *rôle* of inhalation in the transmission of human tuberculosis is considered by the generality of doctors as preponderating and almost exclusive. On the one hand the clinique establishes that pulmonary phthisis is the most frequent form; on the other hand virulent dust constitutes the ordinary vehicle of the bacilli, and the mucous membrane of the respiratory tract appears the only part open to infection. It is necessary, however, to constitute a series of hypotheses in order to explain transmission by this method, and to submit them to trial.

(1) *Rôle of Tuberculous Dust.*—The desiccation of sputa is slow, and its conversion into powder neither so simple nor so easy as seems credible. Deposited in large quantity on a glass plate expectorations are not dry on the surface until towards the sixteenth day, and ten to twelve days must elapse before they can be easily pulverized. At the end of ten days, with air and light their virulence for the guinea-pig intra peritoneally has already disappeared. On the contrary ingestion and inhalation combined of the same products still kills a guinea-pig.

Destruction of virulence depends in a variable time on a series of conditions. Ejected on non-porous stuff (stone, porcelain, waxed plates exposed to the summer sun) sputa has lost its virulence after forty-eight hours. Mixed, on the contrary, with porous material (cinders) ir resists as long as if kept in obscurity. In artificial light (gas or electric) expectorations exposed on plates in thin mince lose their virulence after forty-eight hours. In obscurity sputa desiccated on a stove at 36° C. preserves an irregular virulence for the guinea-pig with often a very long survival of the inoculated animal.

Is tuberculous dust collected in contaminated media capable of provoking pulmonary tuberculosis by inhalation? In 1887 Cadéac and Malet showed that the virulence is quite exceptional. Cornet on the contrary obtained tuberculosis in a third of his animals. Kelsch, Boisson and Braun (1898) only had negative results with the powder from barracks. The results of Straus, who found bacilli in the nasal cavities of persons sojourning in hospital service, were not decisive. Sirena, Pernice, and Gorna only had negative results by inhalation of dust.

In a new series of experiments conducted on thirty-eight guinea-pigs Cadéac only obtained contagion five times by inhalation of the dust of tuberculous spittle. Of eleven rabbits not one was infected. Thus desiccation and loss of virulence travel together; infection by this method is exceptional; very mobile dust is inert dust.

(2) *Rôle of Liquid Particles.*—Since 1887 Cadéac and Malet formulate the following conclusion: "The respiratory tract is very favourable for the development of tuberculosis when the bacilli which penetrate to the interior are conveyed by a liquid; these bacilli on the contrary are very difficult to implant when incorporated with dust."

Numerous experimental facts have confirmed this statement.

Guinea-pigs and rabbits submitted to inhalation of virulent powder are infected, the more surely the longer the duration of the contamina-

tion. All causes capable of retarding desiccation favour the contagion, notably humidity, so generally incriminated. Fogs aid in carrying the germs of tuberculosis; they constitute also veritable screens hindering the light from exercizing its sterilizing action. It does not suffice to prevent spitting on the soil to hinder infection of the atmosphere, liquid projections (cough, sneezing, strong expirations) are the most dangerous.

Without dismissing the respiratory apparatus as a way for the introduction of Koch's bacillus, we think that tuberculous infection is most often contracted through the digestive tube.

(*Revue Générale de Médecine Vétérinaire.*)

FOUR CASES OF DIABETES IN THE DOG.

BY LANFRANCHI.

(1) PUG dog, aged about 8 years, well nourished, suffering from eczema during the summer. The animal gets thinner for three months, he urinates much, and drinks often. Temperature normal, cardiac beats 100, and respiratory movements 20 per minute. Crystalline lenses are slightly opalescent, eyes affected with muco-purulent conjunctivitis. Urine yellow straw colour, containing 60 grammes of sugar per litre. Exclusive flesh diet seemed to produce some improvement; then at the end of twenty-five days general state is aggravated, and death occurs with coma.

(2) St. Bernard dog, aged 13, used to abundant and dainty nourishment. The subject going thinner for some time. Heart is accelerated (125 pulsations). Crystalline lenses opaque. Urine contains 56 grammes of sugar per litre. Flesh diet increases the sugar in the urine (96 grammes per litre). The dog is killed with chloroform. At the autopsy fatty degeneration of the liver and spleen is established. Pancreas is healthy.

(3) Maltese dog, aged 13, very thin. Crystalline lens is opaque. Pulsations 120 per minute. Urine contains 50 grammes of sugar per litre.

(4) King Charles bitch, aged 8. Very thin, complete cataract. Urine contains 57 grammes of sugar per litre, arterial blood 7·60 grammes sugar per litre, venous blood 5·90 grammes, per litre. Liver and kidneys affected, with fatty degeneration. Pancras healthy.

In these four observations one can attribute a great etiological influence to intensive alimentation and lack of exercise. Alterations of the liver seem to play the chief *rôle*.

(*Clinica Veterinaria.*)

SARCOMA IN THE BLADDER.

BY STAFF VETERINARY-SURGEON KULL.

ON a farm in East Prussia a well-nourished Bavarian working ox, aged 6, fell ill in October, 1907. Since he had been bought good health prevailed, but on this occasion he showed symptoms of colic. The day previous he was at plough, but had not been overworked. According to the owner, he had received laxative and

anodyne medicine and several clysters, which had allayed pain and caused copious defæcation. During the day he strained, but did not pass any urine; as evening came on violent pain arose, and an unfavourable result being feared, he was slaughtered. On opening the abdominal cavity, a bucketful of urine was found free therein; the bladder was ruptured.

Arriving at the place immediately after slaughter, I found the following: The large glandular viscera, as well as the heart and lungs, showed no essential changes. In the lower and hinder wall of the bladder, however, there was a rent 3 to 4 cm. long, with irregular, blood-soaked edges. The whole internal surface of the bladder was completely filled with numerous longish, round tumours from a cherry to a pigeon's egg in size, which were situated between the muscular tissue and mucous membrane, and had left the latter uninjured. The bladder wall and the urethral wall at its upper end were very thick; one of the tumours had pressed into the urethra and blocked it. The neoplasms had no doubt been present a long time without affecting the general health of the animal. Owing to closure of the urethra by one of the swellings, colicky symptoms arose, and eventually led to rupture of the bladder. Microscopic examination showed that the tumours were spindle cell sarcomas.

(*Zeitschrift für Veterinärkunde.*)

A CASE OF PURULENT INFLAMMATION AND DEGENERATION OF THE GLAND OF THE MEMBRANA NICTITANS IN A COCK.

BY VETERINARY-SURGEON WITTE.

A TWO-YEAR-OLD cockerel was brought for treatment with the history that he had showed a swelling on the left eye for four weeks, which remained stationary in size.

Examination revealed a swelling as large as a hazel nut extending from the inner canthus of the eye to the left nasal opening, which pressed the eyeball into its socket. The feathers under the inner angle of the eye were matted. From this canthus a shiny, watery fluid filled with little yellow flakes escaped in drops. The swelling felt hard, and only in one little place was it soft. The membrana was swollen and hyperæmic, but movable. The conjunctiva was cloudy; vision hindered. The general state of the cockerel was good.

Removal of the matted feathers showed the external skin coloured yellow. A probe through the duct of the gland only passed about 5 mm., and encountered firm soft resistance.

Expecting pus at the soft spot in the swelling, an incision was made there about 1 cm. long. No fluid was voided, but in the depth was a clear, yellowish, dry, crumbly mass, which was partly removed with the tweezers. In order to remove this mass, the eye was cocainized and the place cleansed with boric solution; an incision was then made the whole length of the swelling, and the clear yellow mass surrounded by a thick, smooth, capsule-like layer was completely

removed. There was little bleeding; the cavity was rinsed with boric water (and the duct injected), filled with dermatol, and the cock set at liberty. The cavity soon filled with healthy granulations. After four weeks the skin wound had cicatrized. The cloudiness of the cornea unfortunately remained.

(*Zeitschrift für Veterinärkunde.*)

THE Board of Agriculture and Fisheries desire to remind all growers of potatoes that it is their duty under the Destructive Insects and Pests Order of 1908, to report all outbreaks of Warty Disease or Black Scab (*Chrysophlyctis endobiotica*) on their premises to the Board. The penalty for failing to report the disease is £10. Certain British Colonies now require a certificate from the Board with every consignment of potatoes exported to them from this country, to the effect that the potatoes have been grown in a district not infected with this disease. Exporters who require further information can obtain it on application at the Offices of the Board.

14, Whitehall Place,
London, S.W.,
August 17, 1909.

Books and Periodicals, &c., Received.

Bulletin of the Sleeping Sickness Bureau; Progressive Case-taking Note-book (R. G. Saunders); Reports of Proceedings under Diseases of Animals Acts, &c., for 1908; Bureau of Animal Industry (A. D. Melvin); Equine Anæmia, by W. B. Mack, D.V.M. (University of Nevada); London University Gazette; Report of the Chief Veterinary Surgeon for the Cape of Good Hope; Tropical Agriculturist; Agricultural Journal of the Transvaal.

Letters and Communications, &c.

Captain Gamble, S.M.; L. M. Douglas; R. G. Saunders; Board of Agriculture and Fisheries; Department of Agriculture and Technical Instruction for Ireland; B. Kühn; Messrs. Merck, A. Peters; The Abbot Alkaloidal Company; J. F. Simpson; A. Noël Pillers.

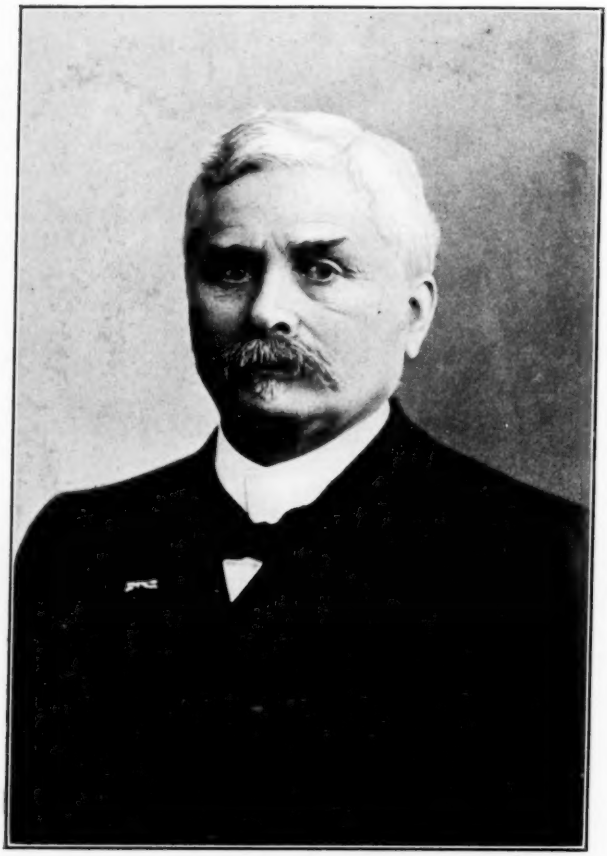
NOTE.—All communications should be addressed to 8, Henrietta Street, Covent Garden, London, W.C. Telephone, 4646 Gerrard. Telegrams, "Baillière, London."

Letters for the JOURNAL, literary contributions, reports, notices, books for review, exchanges, new instruments or materials, and all matter for publication (except advertisements) should be addressed to the Editors.

Manuscript—preferably type-written—should be on one side only of paper, marked with full name of author.

Illustrations for reproduction should be in good black or dark brown on white paper or card.

Advertisements and all business matters relating to the JOURNAL should be addressed to the publishers, Messrs. Baillière, Tindall and Cox.



PROFESSOR W. C. SCHIMMELL.

President of the International Veterinary Congress, 1909.